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MARTIN'S

NATURAL HISTORY.

TRANSLATED FROM THE THIRTY-FIFTH GERMAN EDITION,

BY SARAH A. MYERS.

CONTAINING TWO HUNDRED AND SIXTY-TWO

BEAUTIFULLY COLORED ILLUSTRATIONS.

SECOND SERIES.

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CLASS IV.

ICHTHYOLOGY.—FISHES.

This class, destined to live in the water, differ from all other vertebrate animals, by having gills, instead of lungs, through which they breathe. These, placed on the sides of the neck, consist of a number of laminæ suspended on arches, through which are spread a tissue of innumerable blood-vessels, as may be observed by every one who will take the pains to examine; these are commonly called the ears of fishes. These laminæ, connected with the cavity of the mouth, suffer a portion of the water swallowed to escape, or, at the pleasure of the creature, the whole mass. Fishes, however, do not take in water by breathing, but only the dissoluble air it contains; a fact easily proved by observation. If the supply of air contained in water is cut off, the fish die just as a bird or small animal confined under a glass case would, after the pure air is exhausted. Thus, for instance, if a lake or pond should be frozen over entirely, during a hard winter, it is necessary that holes should be cut in the ice, or the fish would all die. If a fish is kept in a glass vessel containing a small amount of water, it must be frequently renewed, or most likely the creature will die, because the air loses its purity; but if only a little oil is poured on the top of the water, the fish will certainly

smother, because it has no air; and this is also the case in water from which the air has been driven by boiling. These are satisfactory proofs that breathing by gills is possible only in water containing air. The next question may then be, Why do fish so readily die on being taken out of the water? there is still air to breathe, and it may be more easily taken into the gills than that contained in water. The answer is as follows. As soon as a fish is taken out of the water, the coverings of the fine laminæ of the gills begin to lose their elasticity, and, adhering to one another, prevent the free circulation of the blood through their minute vessels; and this increasing the longer these organs are exposed to the influence of the atmosphere, they ere long become dry, and the fish dies. Some of the species, perhaps not so tender, or of which the bronchiæ, by some different arrangement of their external organs, are not so susceptible of becoming dry quickly, can, by being surrounded with damp substances, sustain life for a considerable length of time. Carp, enveloped in moss and kept wet, are conveyed great distances, and can be preserved alive for many days in cellars; and eels, too, in damp nights, often leave the water to seek for food on land.

The whole structure of fishes is as perfectly arranged to serve them for swimming as that of birds is adapted for flying. Living in an element of nearly the same specific gravity as their own bodies, they do not require extended members to support them or aid their movements. The forward motion is effected by the expanded horizontal fins. The tail, serving as a rudder, enables the fish to direct its course, whether upward, downward, right or left. These fins, which represent forefeet, are called the *pectoral* fins; those placed farther backwards are called the *abdominal*

or *ventral* fins; the vertical fins possessed by many, which rise up on the back, are termed the *dorsal*, and are often armed with sharp points; those on the lower surface of the body, corresponding to the dorsal, are designated as the *anal* fins; and the one which terminates the tail, the *caudal*. Most of them have a sac in the interior of their bodies, by which they can render themselves specifically lighter or heavier than the water; this sac, called the *air vessel* or *swimming-bladder*, can be compressed or dilated at the pleasure of the fish, as it rises to the surface of the water, or sinks to its depths. In some this bladder is wanting; such either keep near the bottom, and can only rise slowly, by the aid of their fins. It sometimes occurs in the torrid zone that fish remain too long on the surface of the water; when this is the case, the sun's rays, falling fiercely, so operate on the air contained in the swimming bladder that it can not be compressed, and the poor creatures must remain where they are until the cool of the evening, before they can sink to the bottom.

The figure of the head varies in different species; the senses of seeing and hearing are acute; some possess that of smell in a high degree, as they are attracted by strongly odorous bodies at a considerable distance. The sense of taste, on the other hand, is not well developed, as the tongue is often osseous, and furnished with teeth. Their whole bodies are covered with scales, or a parchment-like skin; therefore the sense of touch is not very acute; there may be some, having fleshy projections from their mouths, that form an exception; these are called the beard, and serve as feelers for groping about in the mud after worms, etc. Their teeth are of a peculiar form, exhibiting no difference as cutting, canine,

or molars; still, from their figure it can be determined whether the possessor belongs to the race of carnivora, or lives on vegetable aliment.

In the former they are bullet-shaped, or sharp and pointed, sometimes filling the mouth, palate, and even disposed all over the tongue, as, for instance, in the pike. In others, that live on vegetables and worms, they are either cartilaginous, or entirely wanting, as in the carp. It is doubtful whether fish ever sleep, as they keep going both night and day after bait, but it has been clearly ascertained that they pass the winter in a benumbed state, hidden in the mud. With few exceptions, fish lay eggs which are called roe or spawn; the females are therefore designated as spawners; the male, milters. When the time for spawning has arrived, they leave the deep waters and ascend the shallower streams, either because the temperature, being warmer, is more favorable for the development of the roe, or that more water plants are found on the shores, to which the spawn can adhere. The reproductive powers of fishes are incredible; the roe of a sturgeon has been known to weigh two hundred pounds; each pound containing thirty thousand eggs, makes the whole number found in the roe amount to six millions; those of the stock fish have been reckoned to number nine millions; those of the carp thirty thousand; herrings forty thousand. This astonishing capability of increase, which is a substantial fact, is modified by circumstances which serve to regulate the number produced to a more proportionate medium. The enemies of fishes and their spawn are innumerable; waterfowls, carniverous fishes, reptiles, seals, dolphins, the polar bear, but especially man, pursue them unrelentingly, and thus the myriads of spawn form the food of different species. No

class of animals is so generally used for food as fish, as their flesh is mostly tender, well tasted, and considered wholesome; however, some of the salt water tribes, and the roe of the barbel, are, in many cases, believed to be poisonous. The skeleton of fishes is ordinarily bony; when these bones are found pointed and sharp, they are termed rayed or ridged; and on this account, namely, the species having spinous fins and firm bones, are recognized as rayed or osseous fishes. Others, having the skeleton cartilaginous, and without those bony fibers, are termed cartilaginous fishes. In a few of the latter class, the shark, for instance, the gill covering is immovable, and gives foundation for a separate distinction. The rest are classed according to the quality and disposition of their fins, or bodily conformation; and thus we find them divided into eight orders, as follows:

FIRST ORDER: . . . (*Acanthopterygii,*) SHARP-FINNED.—Distinguished by having the dorsal fins covered with sharp spines, whether those spinous rays sustain them or not.

SECOND ORDER: . . (*Malacypterigii Abdominales,*) SOFT-FINNED.—Without the spinous rays, and having the ventral fins situated behind the pectoral.

THIRD ORDER: . . . (*Malacopterygii Subbrachii,*) SOFT-FINNED.—With pectoral fins above the ventral; spinous rays wanting.

FOURTH ORDER: . . (*Malacopterygii Apodes,*) SOFT-FINNED.—Without ventral fins, as the Eel kind.

FIFTH ORDER: . . . (*Laphobranchii,*) NEEDLE FISH.—With long, slender bodies, covered with firm skin.

SIXTH ORDER: . . . . (*Plectognathii,*) BULLET FISH.—From the globular form of their bodies.

SEVENTH ORDER: . (*Sturiones,*) CARTILAGINOUS FISHES.—With free branchiæ, as the Sturgeon, etc.

EIGHTH ORDER: . . (*Selachii,*) CARTILAGINOUS FISHES.—Branchiæ adherent, as Sharks, Lampreys, Rays.

FIRST ORDER.

OSSEOUS FISHES.—(*Anthropterygii.*)

The *Percoides* belongs to this class. Their bodies are covered with rough scales; the pectoral fins are composed of five soft rays; the jaws and palate are armed with teeth; the tongue is smooth. The most remarkable of this family is

The *Common Perch* (perca fluviatilis). Is about nine inches in length—sometimes a foot; weighs from a half to two pounds; greenish-brown above, with a golden shimmer on the sides; the ventral and anal fins are red. Found in all the rivers and ponds of Europe, as well as in Northern Asia and the United States, and is one of the best fish brought to the table. Their spawn resembles net-work. One perch will produce two hundred and eighty thousand eggs. They swim very rapidly, and keep at a certain depth. Their food consists of aquatic insects and small fish, wherefore they are very injurious to the young races of other species. Those who wish to keep them, place them in ponds with white fish, because the latter are of little worth. The perch is very tenacious of life, and, in winter, will survive a journey of many miles. If the lightning flashes on the water in which they live, they leap up to the surface. They are easily caught by an angler who understands throwing his hook to the proper depth in which they swim, as they are very greedy, and catch at every thing near them.

The *Wolf's Perch* (labrax lupus) is remarkable for having the gill-coverings clothed with scales and spines. The length is three feet; weight thirty pounds; blue-green above; white below, with a silver-like spot on each

scale. This species is found in great numbers in the Mediterranean Sea, and in ancient times was esteemed as a peculiar delicacy. It is a fierce and ravenous fish, and bites at every thing within its reach. From this voracity, as well as its depredations on all the finny tribes found in its vicinity, it has received the name of the wolf-fish. It sometimes leaves the sea, and goes up large rivers. The sea pike of South America resembles it; silver white, with a golden luster and yellow fins. It is, however, greatly preferred as an article of food.

The *Sand Perch* (perca lucioperca) is commonly one foot and a half long; silver-colored, with short, transverse bands on the back; the pectoral fins are red. This much valued fish is found in the fresh waters of North Germany and Southern Russia; also in the Danube and Caspian Sea, where it is found three feet in length. It is a ravenous fish, delights in deep waters, is by no means hardy, and endures the winter by covering itself in the sand. The flesh is better and harder in autumn than at other seasons. Sand perch are generally eaten boiled.

The *Letter Fish* (perca scriba), found in the Mediterranean, is nine inches long; striped irregularly with blue lines; lives on small fish and snails. The *Saw Perch* has no lines, is no larger, and, like the above, esteemed a table luxury.

The *Rock Fish*, or *Striped Bass* (perca labrax), is a sea fish that has the tongue covered with asperities. In most respects resembles a perch. On the sides are parallel lines, like narrow ribbons, which give it the name. It abounds on the Atlantic shores of the United States, and is much esteemed as an article of food.

The *Red* or *Claret Perch* (anthias sacer). The scales

shine like gold and rubies; on its back are green spots; three gold bands adorn the head. The naturalists of early times tell marvelous tales of its rapacity. Its flesh is best in winter.

The *Giant Perch* (perga gigas) measures three feet in length, and weighs over twenty pounds; is of an ochre color, spotted with brown; has very small scales, and is found in the Mediterranean Sea. Its flesh is considered very palatable.

The *Stone Perch* (perca cernua) is found in all brooks; six inches long, slimy, and with a large head; greenish-brown above, silver colored and shining below; feeds on larvæ found in the water and young fish. This fish is common in North Germany, and is much esteemed on account of the excellence of its flesh, which is both wholesome and palatable. Very tenacious of life, it will bear transportation during the winter, and, although seemingly frozen, is easily revived. There is another species, peculiar to the Danube, which resembles the stone perch, but is larger.

The *Star Gazers* (uranoscopus scaber), plate 20, fig. 9, are wedge-shaped, with large, flat, angular heads, which are defended with a kind of mail. The ugly mouth opens directly in front, exposing the sharp teeth; the eyes protrude from the forehead upward, from which peculiarity they receive their name. Measuring ten inches in length and two in thickness, brownish-green above, pale white below, they are sluggish creatures, hiding beneath the sea-plants, where they angle for fish, which they take with their beards. The flesh is poor and bad.

The *John Dory* (trachinus draco). This fish, also called Dorado, is a foot long, reddish-gray, with blackish

spots, and found on the western coast of France, the British channel, and the Mediterranean, and is rather dreaded on account of its spiny fins, the wounds inflicted by them being dangerous. Fierce and very tenacious of life, the creature defends itself boldly when attacked. The flesh is good. There is a smaller species, whose thrusts are even more dreaded, as they produce inflamation, which is sometimes fatal.

The *Surmullet* (mullus surmuletus) is rather thick and bearded, living on aquatic plants and animals, seldom larger than a carp, its usual length is nine inches. This fish, as also the *Red Mullet* (mullus barbatus), is much prized for the excellent taste of its flesh and its beautiful color, purple, glancing with silver. In ancient times it was celebrated on account of the pleasure the Romans took in contemplating the changes of color it displays while dying. Exorbitant prices were paid for these fish, and, at entertainments, they were brought to the table alive and cooked before the eyes of the guests. They are taken in nets, or by hooks, baited with crabs. There is a smaller species, which is also beautiful.

The *Gurnet* (trigla gurnardus) is about two feet long, brown-gray with white spots above, white below, and found in all the seas of Europe. It lives on crabs and muscles, and when swimming at night emits a phosphorescent luster; when taken from the water, it gives a kind of growl. The flesh is used for food.

The *Flying Fish* (trigla volitans) have the pectoral fins so long that they use them as wings; they measure one foot, are dark colored, spotted with blue, orbicular figures that look like the eyes, often seen on the wings of butterflies. Their mouths are filled with bead-shaped teeth, which cover the whole inner surface, are found in

the southern seas, and sometimes, but very rarely, in the Mediterranean. When pursued by rapacious fishes, such as the bonita and others, they spring into the air, and are able to maintain a flight of the distance of a gunshot, when the fins become dry, and they fall back into the sea and occasionally on the deck of ships. The flesh is lean and hard, but palatable.

The *River Gudgeon* (cottus gobio) has a wedge-shaped body, covered with scales; the head broad, not unlike that of a frog, and a large mouth provided with two small *cirri* or prickles. The gudgeons do not exceed four inches in length, live in company with the groundling in spring waters or mountain streams, darting from place to place with uncommon vigor. They feed upon aquatic plants and spawn, are generally taken with the hand, and considered good eating.

The *Sea Gudgeon* resembles the above, but is larger, being one foot and a half in length, and, with a head covered with bony knobs and prickles, are of a hideous appearance. Many consider the stings of the prickles as poisonous. It is not valued as an article of food, as its flesh is bad.

The *Stickleback* (gasterostus aculeatus), scarcely three inches long, is of a silvery whiteness, with yellow fins; on the dorsal fin are three spines, on each of the abdominal two. It is found in all brooks and ponds, is abundant in Europe. The female hides her eggs in the sand, and watches over them. These fish live on spawn and water insects, but are seldom preyed upon by rapacious fishes on account of their spines. They are so numerous in North Germany that the farmers use them as compost, the only manner in which they can be made serviceable,

as they are not fit to be eaten. There is a smaller species.

The *Daurade* (sparus aurata), one foot long, is silver gray, with a shimmer of green, of a lustrous white below, and has twenty horizontal lines of golden brightness on each side. It inhabits the Mediterranean, is very fat, and once a table delicacy in the luxurious times of the old Romans, is still esteemed as a dainty. It feeds on shellfish, which it cracks open like a nut, and by the noise thus made betrays itself to the fishermen. Very susceptible to cold, it betakes itself, in winter, to the bottom of the sea. There are numerous species of this race, which are termed *Sparoides*.

The *Chætodons* (chætodon rostratus) are remarkable for their long, slender muzzles, open only at the end, resembling a tube. They measure six inches, are yellowish, but shine with metallic luster, and are striped and ringed with brown. They frequent the mouths of large rivers in Java, and are well known for their singular method of securing their prey. As soon as a fly is seen to settle on a plant, the *Archer* or *Shooting Fish*, as it is sometimes called, swims within four or five feet of the victim, and, with a dexterity which never fails of its aim, projects from its nozzle-shaped snout drops of water, which throws the insect down; it is then at once seized upon as booty.

The *Mackerel* (scomber scomber) is rather slender, with small scales, weighs two pounds, has a blue back, marked with undulating black stripes, is silver-colored below, has no swimming bladder. The mackerel is a migratory fish, and at certain seasons abounds on the coasts of the United States and Europe, and is taken also in great numbers on the western coast of England. Very

voracious and a determined enemy of herrings, they follow after these fish in great shoals; therefore they are often caught and sold at the same time in the sea-port markets. They are taken in nets, mostly in the summer at spawning time; these nets, loaded with lead below, and kept afloat by empty barrels above, and sometimes more than a league in extent, are cast into the sea; the meshes are wide enough to receive the head of the fish, but arrest and entangle it by the gills and fins. The fishery is often conducted by torchlight, and many hundreds are taken at a single haul. It is said that mackerel become blind in the winter, and that, during the cold season they bury their heads in the mud, leaving a third part of their bodies exposed. In a decaying state, the mackerel emits a shining light; the water in which it has been boiled possesses the same phosphorescent property. The flesh is very fat and well tasted, but will not bear transportation, except salted, as it spoils easily. Mackerels are also caught by hook and line.

The *Tunny* (scomber thynnus), plate 21, fig. 8, is commonly two feet in length, and seven pounds in weight, steel-gray on the back, elsewhere silvered, found in all the seas, but abounds in the Mediterranean, where it attains to the length of a man. None of the finny tribes are so rapacious as this, since it does not spare its own species. The flesh, when cut in pieces, resembles raw beef, but when boiled turns pale and tastes like salmon. These fish are taken by hook and line, and in Sicily in nets of very singular arrangement. A kind of labyrinth made of nets is stretched out vertically in the sea, and so constructed as to form a series of chambers, open from the land side by a sort of door, and united by another net, which bars the passage and arrests the fishes in their

course along the shore. The tunnies first pass between the shore and the first chamber; having entered this, the opening is closed, and with loud cries which bewilder the poor creatures, the fishermen drive them into the labyrinth, from whence they can not escape. The outer opening is then unclosed in order to admit the passage of new victims; and this work is continued until the net is filled. They are then killed with harpoons and spears; sometimes, however, they resist powerfully, and tear the nets. The tunnies swim rapidly and perseveringly, following after ships for sake of the kitchen offal. They are often preceded by a shoal of sardelles, which are driven into the net by the dolphins. The fishermen spare the latter on account of this friendly office. The flesh of the tunny is poisonous as soon as it begins to decay, which is easily ascertained by the back bone becoming red. This fish was dedicated, by the ancient Greeks, to Diana; the Italians impress its image on their coin, and regard it as the emblem of conjugal fidelity. From the roe and entrails of the mackerel, tunny, and others of the Scomber tribe, the celebrated fish-sauce, called *garum*, was made; it was in great repute in ancient times, but the manner of its preparation is no longer known.

The *Sword Fish* (xiphias gladius) is distinguished by the beak, or long, sword-like point, which terminates the upper jaw; the scales are so small as to be scarcely discernible. It most generally measures six feet, sometimes fifteen, the sword making one-third of the length. The color is blue above; white below. The prolongation of the muzzle is flattened horizontally, and instead of teeth the jaws are furnished with strong asperities. Is found in all the oceans, but abounds in the Mediterranean.

The sword fish mostly swims in pairs, and lives on plants and small fish, and although many stories are told of the use it makes of its pointed muzzle as a weapon of offense, it seems scarcely credible that such formidable blows can be given by it, as it is flexible, and seemingly weak. The flesh is much prized, and the fins considered a luxury.

The *Pilot Fish* (centronotus ductor). One foot long, with four spinous rays on the back, like the stickleback; altogether blue, with transverse bands of darker shade. This beautiful fish is found in all the warmer seas, and from its always being found in company with the shark, probably directed by the same instinct to seize what may be thrown overboard, it is believed to be the conductor of the latter to the neighborhood of prey. They live in the greatest harmony with each other. If a bait is thrown to the shark, the pilot fish swims first toward and around it, and then returns to its companion, as if to inform him of the qualities of the examined object. If the shark is taken, the pilot fish remains near the ship until the carcass is drawn up on deck. Another species of the Centronatus tribe, of a bluish-gray color, and about five feet long, is said to cater in the same manner for the tunny.

The *Sun-fish* or *Smith* (zeus faber), is smooth, with a strong dorsal fin; lives in the warm seas; measures two feet in length; silver gray, inclined to yellow, with a round black spot on each side. This spot is supposed to resemble a coin; therefore, it is a general belief that this is the fish in whose mouth St. Peter found the tribute money. It receives its name of the *Smith* because in the form of its bones is found an imaginary resem-

blance to all the tools used by blacksmiths. Its flesh is palatable, but it is now rarely found.

The *Dorado* (coryphæna hippurus). The head is higher than the rump, and the forehead so perpendicular that the head resembles that of a child. It is four feet long, bluish-gray above, green on the sides; bright yellow below, but shines all over with a golden luster. This beautiful fish is found in all the oceans and the Mediterranean Sea, mostly the former; the fishermen call it the *Gold Fish.* It is extremely voracious, swallowing everything that comes in its way, even nails. It follows the flying-fish with such haste as to overtake it as it springs into the air. The flesh is esteemed a dainty.

The *Rapier Fish* (trichiurus lepturus) is in form like a small sword; smooth, and wanting the abdominal and caudal fins; the under jaw is longer than the upper; it is over three feet long, and shines like silver; the tongue is long and triangular, like that of a bird. It inhabits the Atlantic Ocean, is a good swimmer and rapacious robber, often darting so suddenly out of the water when pursuing its prey, that it falls upon the deck of ships; its flesh is good.

The *King of the Herrings* (regalacus g'esne), sometimes called *Ribbon Fish*, is smooth, elongated, and flattened on the sides, thus obtaining the name. It measures ten feet in length; is of a silvery white, lustrous, and adorned with black spots, and, always swimming in advance of a shoal of herrings, has been termed the king.

The *Surgeon* (acanthurus chirurgus) is small; the skin leather-like, with a movable spine, sharp as a lancet, on the cheeks and each side of the tail. These spines are of the shape of a surgeon's lancet, and inflict severe

wounds on those who imprudently take hold of them. This fish is about nine inches in length, yellow above and blue below.

The *Climber* (anabas testudineus) is a span long; very slimy; green above, yellow below, with a great number of small prickles on the posterior portion of the branchiæ; it is found in the East Indies, living in ponds, ditches, and swamps, where it feeds on insects. The anabas can remain a long time out of water; creeps to the land, and on the grass, and climbs trees by the aid of its strong branchiæ and tail it is supposed in search of the moisture collected by the leaves in the rainy season. It is esteemed a table dainty.

The *Sea Mullet* (mugill cephalus) measures more than a foot, and weighs about eight pounds; is brownish-gray above, with a prismatic luster of blue and gold; the sides are silver-hued, and is found in numbers in the Mediterranean, where it lives on mud and worms. The favorite resort of this species is at the mouths of rivers, and in the summer time are taken by hundreds; frequently, however, resisting so strongly as to break the net. They are salted and smoked; the French make a kind of caviare from the roe. The sea mullet is a rapid swimmer, and can not be caught with a hook, on account of its small mouth.

The *Anchovies* (aterina vera) are small sea fish that are found in shoals in the Mediterranean; about the thickness of a finger; four inches long; brown above, silvery below, and are taken in great numbers along the coast. They have a great many bones, like the sardines, but are held in great repute as an article of food; there are several smaller species, quite as numerous, all resembling each other.

The *Burbots* (blennius vivaparous) have a naked slimy skin, thick, stumpy heads, and of a foul yellow color, spotted with black; are more than a foot long, and weigh one pound; the nostrils are extended and reed-shaped. These fish, also called *Eel-pouts*, bring their young, living, to the world, often to the number of three hundred. They inhabit the depths of the North and Baltic Seas. Their flesh is bad; their food consists of the spawn of fish, crabs, and worms.

The *Sea Wolf* (ananichas lupus), plate 20, fig. 10, has a thick, obtuse head, small scales, and is slimy; the body is clumsy, the mouth wide, with large tuberculous teeth; the dorsal and anal fins are very long. It measures four feet; gray above, blue-gray on the sides; the tongue smooth and fleshy, and it is said to bite so fiercely as to leave the marks of its hard teeth on an anchor. Shell fish are its favorite food, the hardest of which it crushes easily within its jaws; but it is also a determined enemy to other fish. Ferocious and ravenous, it is not only formidable to the inhabitants of the deep, but the fishermen also dread it, as, when captured, it makes a furious resistance, and fastens upon everything within its reach. It is found only in the northern seas, where it deposits its spawn near the coast. The flesh is fat and solid, but not well tasted. The Greenlanders use the skin to make bags, etc.

The *Gudgeons* (gobius niger) are wedge-shaped and slimy, with small scales; six inches long; the fins of a beautiful black; found everywhere in Europe, but especially abound in the Mediterranean. The sea gudgeons, if they can not find crevices in the rocks, dig canals in the mud at the bottom, and in spawning time construct a roomy dwelling in the sea grass, with which these canals

or galleries communicate. The male guards the entrance; burying his slimy body in the cavity, he keeps his bearded mouth exposed, and the spawn being deposited, he keeps faithful watch over it for two months. Owing to this custom of providing a home for the young, this fish is also called the *Architect*, and is valued on account of its good flesh. The liver is considered a dainty. There are several smaller species.

Periophthalmus (periophthalmus schlosseri) resembles the foregoing in conformation, has large teeth, a fleshy tongue, an obtuse head, soft scales, and eyes very close together. The pectoral fins form a kind of arms, the fins being on the end. Its home is the Indies, and it is found in great numbers in Amboyna. A very remarkable property of this fish is that it can live on land as well as water; mostly lying in the mud, it protrudes its arm-like fins, and these becoming dry, it can run like a lizard. It feeds on insects and young crabs.

The *Frog Fish* or *Sea Devil* (lophius piscatorius). This fish is extremely misshaped; its large head is scarcely distinguishable from the body; the tail small and thin. The sea devils are without scales; their broad, transversely-cleft mouths are furnished with strong and pointed teeth, and armed with long cirri, or beards, and on the shoulders are movable prickles; the gill-coverings are sack-like, so that they can be used as cheek pouches. They measure four feet in length, and are found all over Europe. The fishermen kill and throw them away, because they are rapacious and their flesh not eatable. They swim badly on account of having no air-bladder; and being very voracious, hide themselves behind water-plants, lying in wait for small fish, which they take by letting their long beards play about in the water; these

cirri, looking like worms, allure the unsuspecting prey, which is seized upon immediately. Resembling these, but of even more singular conformation, is

The *Toad* or *Swell Fish*, sometimes called *Blower*, which has the faculty of inflating its body like a balloon.

The *Sargus* (labrus julis), a kind of tench, well known to the ancient Romans, has a double fold on the lips; the teeth in front are conical; the molars, of which there are three rows, are in form like paving stones; is not more than a span long; nevertheless it is considered the handsomest fish in Europe. It is remarkable for a zigzag stripe of a brilliant gold color running along the sides the whole length of the body on a violet ground; this, likened to the badge of an order, changes in the light to every prismatic luster, varying from celestial blue to silver white, from the rosy tint of dawn to the golden hue of sunset. Its food consists of shell and other fish.

The *Sea Parrot* resembles the sargus, but is not near so beautiful.

The *Red Deceiver* (sparus insidiator) belongs to the small family of menides, which in form resemble the carp. In length one foot; red above, gold color on the sides, with the mouth very protractile. This muzzle, which is longer than the head, the animal can, at will, contract into a tube, and use it for seizing the small fish on which it feeds. It is found in the Indian Ocean.

The *Parrot Fish* (scarus creticus) has large, smooth scales; the jaws are rounded; the teeth are arranged like mosaic work, and in size equals the foregoing. Its color is either blue or red, according to the time of year. It lives in the Mediterranean, and was known to

the ancients, who described it as living on sea grass only, and was so affectionate to its own kind, that on one of the race being taken, others were at once ready to rescue.

SECOND ORDER.

MALACOPTERIGEAN ABDOMINALES.—SOFT-FINNED.

These have the ventral fins suspended under the abdomen, behind the pectoral. They are mostly found in fresh waters. To them belong first

The *Carps*, which have a slightly-cleft mouth and weak jaws, most frequently without teeth, but have a masticatory apparatus in the back part of the palate. The tongue is smooth. They have only one dorsal fin, and the body is covered thickly with scales.

Of the Cyprinidæ the most remarkable is

The *Common Carp* (cyprinus carpio), a fish generally known; olive-green above, yellow below; ordinarily one foot in length, and weighs from two to three pounds, although it sometimes measures four feet, and reaches a weight of seventy pounds. The cirri, or filaments of the beard, are short. Their food is composed of all kinds of worms, insects, roots, rich earth, etc. This fish delights in tranquil waters or slowly-flowing rivers. Towards the end of May they seek a shallow place, in which to deposit their spawn, and sometimes journey a long distance before a suitable one is found. If any obstruction presents itself, they overleap it with great

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dexterity; rising to the surface, they turn on one side, and bending the body like a bow, by bringing the head and tail together, with a rushing movement spring over the opposing obstacle, often to a distance of three and four feet. Carp that are well fed grow very rapidly and live to be very old; some, it is said, are known to have lived two hundred years. They are, in old age, subject to disease, which shows itself in mossy excrescences on the head and back, and is mostly fatal. The young are not altogether exempt from it, supposed to be occasioned by too much snow water running into the pond, or if they are too long imprisoned under the ice. They are also liable to an eruption like the small pox. On account of their being a profitable article of commerce, particularly in Polish Prussia, carp are carefully bred in ponds, ingeniously arranged into divisions and designated by the names of store, breeding, and fattening ponds. The first receives the spawn and lodges the young in safety; is so shallow that the water may be warmed by the sun, provided with water plants, on which the eggs may fasten, and so situated that neither frogs, crabs, aquatic birds, nor rapacious fishes can approach. The young fry remain two years in this pond, where they find suitable nourishment in the insects and their larvæ found there. They are then taken out and put in the second-named pond, the water of which is not pure, and fed on a variety of articles, such as vegetables, earth-mud, dung, etc. It is necessary to cut holes in the ice during the winter, that the fish may receive fresh air; these are termed Wuhnen. A better method, however, is to let off a portion of the water under the ice, so that a free current of pure air may pass throughout the whole extent. A hail storm is very injurious to these fish, therefore the water ought to

be renewed immediately. As the flesh of the carp, whilst remaining in this pond, acquires an unpleasant taste, the fish are removed to the third pool, where they are fed entirely on vegetable aliment. Every six years these ponds must be drawn off perfectly dry, and cleared of all reed grass or marsh growths; this done, the bottom is sowed with oats, barley, or other grains, so that good food is in readiness for the new comers. The old carp are very cunning and shy of taking a bait, and on seeing the young ones approaching a baited hook, frighten them off by striking them a hard blow with their tail. The writer once observed, in a pond covered with a roof, a number of carp that seized eagerly on pieces of bread thrown them, but when the rain, falling from the eaves, resembled lines attached to the bread, the young were at once driven away by the old ones, who were contented to watch without eating. These fish are taken either by a dragnet or hooks baited with worms. Salt water does not injure them, for they abound in the Caspian Sea. There is a species, called *Shiners*, which are naked on the back, but have the sides and under portion of the body covered with large, shiny scales, from which they receive their name.

The *Bastard Carp* (cyprinus carassius) has no beard; the body is high, and of a yellow brown; green on the back, and pale yellow below; weighs four pounds; feeds like the carp, and is similarly valued and treated.

The *Golden Carp* (cyprinus auratus), originally brought from China, and now kept by many in glass globes for ornament or amusement, is about five inches long, and of a brilliant gold color. These fishes are fed on bread crumbs, wafers, hard boiled eggs, etc. They are now domesticated in our garden ponds or basins,

where they sometimes grow a foot long; swim actively and gracefully; sometimes they acquire black spots. Their flesh is more savory than that of the common carp. The smallest of the cyprinidæ is

The *Bitterling* (cyprinus amarus); greenish-yellow; almost transparent, and of a silvery whiteness on the under surface of the body. Its length is not more than two inches; the flesh has a bitter taste, and is sometimes brought to the table in mistake for the groundling.

The *Barbel* (cyprinus barbus) is longer than the carp; olive green on the back, bluish on the sides, with four filaments, *cirri*, on the lower lip. Mostly one foot in length; is sometimes measures two, and is one of the most common as well as abundant of the tribe; lives in swiftly running rivers, with gravelly bottoms, hiding in holes under the stones. The flesh is white, and well tasted; the roe, however, is said to create pain in the stomach.

The *Gudgeons* (cyprinus gobio), plate 21, fig. 2, are five inches long, with moderately-sized heads; olive-green, with black dots; spotted on the sides with blue, and covered with gold colored scales. They are found in all the rivers of Europe, and in some are very abundant; will feed readily on decaying carcasses: nevertheless their flesh is eaten, and esteemed as being tender and palatable.

The *Tenches* (cyprinus tinca) have very small scales, and are slimy; resemble the carp; are more than a foot in length; the fins are violet color. These fish live in stagnant waters, and feed on the same aliment as the carp; if removed from the muddy pool to clear water, so as to lose the bad taste acquired in the foul, their

flesh is readily eaten, although less esteemed than that of the carp.

The *Red Bream* (cyprinus rutilus) is rather broad; very scaly; dark green above, silver white on the sides; eyes and fins cinnibar red; its length seldom exceeds a foot. It is a timid and cunning fish, darting deep into the water on the approach of any one; its food consists of aquatic plants, worms, etc. It is mostly taken by a hook baited with a dragon-fly; the flesh is altogether inferior, and very bony.

The *Common* or *Pale Bream* (cyprinus brama). Over one foot and a half in length; body large, conical, and covered with scales; sharp on the back; grayish-blue above, yellow-white below; keeps in deep waters, and is so shy that it disappears at the slightest noise; its flesh is white, and much esteemed.

The *Roach* (cyprinus leuciscus) is from four to six inches long; olive-green above, silvery, with a yellowish tint on the sides, the ventral fins red. It is a common fish, the flesh very white and tender, but so full of bones that it is little valued, and therefore sold very cheap.

The *Bleak* or *Blay* (cyprinus alburnus), only five inches long, is thin, and covered with loosely placed silvery scales; bluish-green on the back; found everywhere in Europe, and more used as bait than an article of diet. The nacreous substance which gives brilliancy to the scales, is employed for the manufacture of false pearls. For this purpose the scales, which are easily detached, are taken from the fish, placed in water, and rubbed until the silvery substance which gives them their metallic luster is removed; it is then introduced as a lining to clear glass beads, and gives them the appearance of the finest mother of pearl.

The *Loaches* or *Groundlings* (cobitus barbatula) are not longer than a finger; yellowish, clouded with brown; are also called *Suckers*, from the peculiar form of their mouths; the upper lip is armed with six cirri or beards. They live in clear brooks with gravelly bottoms; are common both in Europe and the United States, and are esteemed for the palatable food they furnish. Suckers are in season from Christmas to Easter. They are rather tender, and easily killed; therefore they are kept in ponds, and fed with such aliment as is suitable, which is placed in holes made in the bottom. Water rats are their greatest enemies. In the United States they do not receive any care.

The *Smerlin* or *Mud Loach* (cobitis fossilis), is about a foot in length, has four cirri on the upper lip, and six on the lower; of a blackish color, striped with yellow. It is almost peculiar to north Germany, but by no means abundant; sometimes, but very rarely, it is found in south Germany. This fish buries itself in the mud during the winter, and if the water in the brooks dries up in the summer, it remains hidden in the mire for several months, coming forth as brisk as ever as soon as streams are renewed. Although this species deposit a great many eggs, they increase but slowly; weak and altogether defenseless, they become the prey of all other fish; crabs are the most inveterate of their enemies. They feed mostly on the larvæ of insects. On the approach of a storm or threatening of rain, they rise to the top of the water, and are therefore considered as infallible barometers. They inhale a great deal of atmospheric air, and when taken out of the water utter a whistling note, which may proceed from anger or pain.

The *Common Pikes* (exos lucius), plate 21, fig. 7, have an oblong, broad, depressed muzzle; strong teeth, and measures several feet in length; are blackish above, gray on the sides, with yellow dots; the young are green, and therefore termed grass pike. The pike is found in all the rivers and lakes of Europe and North America, and, being most voracious and destructive, is the king and tyrant of all the fresh waters. Bold as greedy, it devours with avidity frogs, birds, water rats, snakes, and all fishes that come in its way. Fishes with sharply rayed dorsal fins, which they can not readily swallow living, are held between its strong teeth until they are dead. The stickling is the only one of the finny tribes which is spared by the pike, and this not always, for it is sometimes seized upon by an inexperienced young one, and mostly killed. The growth of these fishes is very rapid, in their third year measuring two feet, in their sixth three, and in their twelfth four. In spawning time, which is in April, it is said they become partially blind; they can then be taken very easily by the hand; the places mostly chosen as safe spots for the eggs, are shallows overgrown with reeds. The manner of fishing for pike is either by the hook or by spearing them; the first is baited either with a small live fish, or an artificial one, made of brass, with red eyes; this, glittering in the moonshine, is very attractive, and they take it readily.

The Romans held the flesh of the pike rather in contempt; at the present day, however, it is much esteemed, and in Europe they are frequently kept in ponds and fed on white fish and carrion. The bones of the skull are most ingeniously arranged, and many of the superstitious pretend to discover in them the form of the instruments used in the crucifixion.

The *Horned Pikes* (exos belone) are very long and slender, and recognized by their oblong, bony-plated heads, wide jaws, and small teeth. They measure about two feet in length, are bluish-black above, green and gold with a shimmer of blue on the sides, and silvery below. The horned pike lives in all the seas, and comes to the shore with the mackerel, and being very voracious, often springs out of the water to seize whatever comes within its reach in the shape of prey. These fishes are taken by the spear, mostly at night by the light of flambeaux. The flesh, lean and hard, is used only for bait; the bones are green. It is also known by the name of the sea pike, garfish, spitfish, and billfish, receiving the latter name from its bill-shaped muzzle.

The *Flying Fishes* (exocœtus volitans) are broad-shouldered and remarkable for the excessive length of their pectoral fins. They are brown on the back, silvery below, and measure about one foot, are found in all the oceans near the equator, and not only spring up out of the water to escape some enemy or barely to fall back again, but their fins or wings with which they really cleave the air, serves to sustain them in their flight for a short time. They rise to a height of twenty feet above the surface, and can maintain a horizontal course for a distance of three hundred feet. Swimming in shoals, several thousand will rise up at once, and falling on the decks of ships, are captured by the crew, and furnish not only an excellent feast, but are ample food for curiosity. It is a beautiful sight to watch them as they rise above the water; for, like a flock of sparrows fluttering from tree to tree, so do the flying fishes fly from wave to wave, not, however, pursuing a course of pleasure, but seeking to escape from a voracious enemy.

The *Silurus* (silurus glanis), plate 20, fig. 4, is recognized by its naked skin and broad mouth, armed with six barbed cirri, of which the upper two are longer than the others. The head is broad, the back raised; the color dark green above, on the sides the same, spotted with black, the under surface yellowish. This fish inhabits all the streams and lakes in Northern Europe and Asia. Its common size is three feet, but it often grows to six feet in length, and its weight exceeds a hundred pounds. It swims slowly, as its fins are disproportionately small, and, instead of pursuing or seeking after prey, lies in ambush, waiting its approach. Two are mostly found together, and quietly floating near the shore, watch the other fish that come by night to their spawning-places, and swimming stealthily round the unsuspecting victims, seize them before they have an opportunity to escape. They are taken with the hook and line. Their flesh is white, juicy, and without bones; their growth is very tardy, and so tenacious of life that they are very hard to kill.

The *Cat Fish* belongs to this species.

The *Cuirassier* (cataphractus callichthys) is covered entirely with bony plates, resembling a coat of mail, has four cirri, very small teeth, and the pectoral fin has a strongly articulated spine for the first ray. The color is bluish-green; the mouth has a peculiar structure, something like that of the frog. Its length is scarcely nine inches, lives in the brooks of South America, and when the water dries up, creeps into the mud. The flesh is much esteemed, and for making soup is considered superior to that of the turtle.

The *Malapterurus* (silurus electricus) has a very broad head and slender body; it resembles the toad fish

or sea devil; its skin is slimy, of a gray color, spotted with black, and has on its lip six cirri, or filamentous beards. It is found in Egypt and Senegambia, and has the power of giving strong electric shocks. Its flesh is palatable. The Arabs call it *raasch*, thunder.

The *Salmon* (salmo salar) is recognized by a very wide mouth, completely armed with strong teeth. The upper jaw in the male is hooked, the lower curved; blue-gray is the color of the back and sides, mostly spotted with black; the under surface is silvery. These fishes are found in all the Arctic seas, whence they ascend the large rivers in great shoals every spring, where they remain during the summer to deposit their spawn, and, like the birds of passage, always return to the same place, which their instinct teaches them how to find; in winter they return to the sea. The salmon delights in rapid streams with gravelly bottoms, swimming in the same order observed by wild geese as they fly, namely, in a triangle, the females in front, the males in the rear, they hold their course directly in the middle of the stream, and, as they swim very rapidly, make considerable noise. The noise of a steamboat or sawmill, the presence of glittering objects, or bright colors, such as a house painted red, will drive them away. They press up the rivers to a great distance, even for hundreds of miles. The young grow very rapidly, so that in their sixth year they will weigh twelve pounds. The best season for catching salmon is in the spring, as they are then fattest; they feed on small fish and water insects. The flesh is reddish, and, much esteemed, is eaten fresh or salted and smoked. Salmon will not live in fish troughs. They are taken in bow or salmon nets of peculiar construction, and, as in their peregrinations they can clear

all obstacles, even a cataract, at a leap, so they often escape from the net. They are much troubled by a small worm which harbors in the gills.

The *Huco* (salmo hucho) is a smaller species and peculiar to the Danube.

The *Lake* or *Salmon Trout* (salmo lacustris) is nearly as large as the river salmon, being mostly two feet long, and weighing eight pounds. Its color is the same, but spotted irregularly with red. This fish is very common in the lakes of Switzerland, but in spawning time, migrates up the rivers. The flesh, which is reddish, turns a golden yellow when cooked, and is much esteemed. The manner of taking it is either by the hook, seine, or bow net. Lake trout feed on small fish, spawn, worms, etc.

The *Common Trout* (salmo fario) is the smallest of the salmon family, measures from seven to ten inches, weighs half a pound, is olive-green on the back, greenish-yellow on the sides, the under surface golden yellow, and sprinkled all over with small beautiful black and red spots. When the golden color predominates, they are called the *golden trout*. Their teeth are many and pointed; living in the clear brooks and mountain streams, they swim rapidly, and, like the salmon, overleap all hindrances. The larvæ of insects, worms, snails, young fish, etc., serve the trout for food; sometimes they will seize on a water snake. The manner of fishing for trout is by a small seine, bow net, or hook and line. The English mostly choose the latter, baiting the hook with an artificial fly, made of silk and horse hair; this bait, held just above the surface of the water, is a sufficient lure for the fish to spring at. As they not unfrequently remain stationary with their heads up against the stream,

it is possible to shoot them. Trout are sometimes kept in ponds, where they are fed with bits of liver, small fish, etc., but they can not live unless the pool is kept pure by a constant supply of spring water. The flesh is very tender, well tasted, and wholesome. Found in all the northern States.

The *Salmon Trout* (salmo salvelinus), plate 21, fig. 6, is about the same size as a trout; brown above, white on the sides, brilliant yellow below, and is found in all the lakes of Styria, Tyrol, and Switzerland. These, the finest of all the fresh water fishes, are taken either in nets, or by hook and line.

The *Chinese Dart Fish* (tachysurus sinensis), plate 20, fig. 1, is remarkable for its large dorsal fin; of a green color above, the abdominal and caudal fins brown. It inhabits fresh waters, and is found in all the lakes in China; swims very rapidly, and as this movement is performed by a sudden stroke of the tail, it has received its name of Dartfish.

The *Herring* (clupea harengus), plate 21, fig. 3, are about a foot in length; two inches broad; have weak teeth; the upper surface of the body bluish-black, the under silvery. They inhabit the northern seas, and migrate towards the south, forming vast and dense shoals, which, arriving on the coasts, cause the water to shine with metallic brightness. This emigration commences in March and continues until May, during which time they are taken in incalculable numbers. They feed on spawn, worms, and small maritime animals.

When the main body of this phalanx is arrived, the fishermen are ready prepared to give them a proper reception, and, by nets made for the occasion, take, sometimes, two thousand barrels at a single draught.

Those containing neither milt nor roe are designated by a peculiar name, are very fat, but must be eaten whilst fresh, as they will not keep. The others are termed *Full Herrings*. The art of curing herrings was discovered in Holland, at an early time, and even to this day the Dutch herrings are considered the best. Very often these fish are salted on board the boats, with coarse sea salt, but on landing, the barrels are unpacked, and resalted; the next process is that of smoking; they are then called *Red* herrings. To effect this, the fish are hung in rows by their heads, on long rods or poles; these are placed in rows, often to the number of twelve hundred at a time, in a kind of drying-house, and smoked over a fire made of dry brush or twigs. Herrings are best to be eaten fresh, but as they spoil readily, they can not be transported in that state to any distance. In order, however, to preserve their original freshness as much as possible, they are what is termed *marinated*—that is, soaked in milk, in order to extract the salt, and afterwards laid in oil and vinegar, highly spiced. The wonderful increase of these fish borders on the marvelous. It is reckoned that a thousand millions are taken every year; as many more perish by the pursuit of rapacious fishes, and yet, in their annual returns, they seem to suffer no diminution.

Resembling the herrings, and scarcely less numerous, on the coast of England, are the *Pilchards*. They are, however, fatter, and altogether preferable.

The *Sardelle* or *Sardine* (clupea sardina), a species of small herring, only six and a half inches, never reaching a span in length, is found in the Mediterranean, and on the coasts of France, and especially of Sardinia. During winter it keeps in the depths of the sea, but

about the month of June draws near the shore in immense shoals. As many as forty and fifty thousands are taken at a single cast of the net, and when salted and cured are sent to all parts of the world. The anchovy resembles the sardine, forms also an article of commerce, and is found on the coasts of France and England.

THIRD ORDER.

MALACOPTERYGIANS, WITH PECTORAL FINS.

This order is distinguished by the situation of the ventral fins, which are placed beneath the pectoral.

The *Cods* (gadus morrhua) have thin, soft scales; naked heads; the ventral fins, sharpened to a point, are attached under the throat; they measure from two to three feet, weigh about twenty pounds, and have a small scirrus on the lower jaw. They are found in the ocean, between the fortieth and sixtieth degrees of north latitude, in fathomable waters, and feed on shell fish, worms, crabs, herrings, etc. They cast their spawn in winter, and the necessity of providing for their subsistence causes them to approach the shore, where they are caught either with hook and line, or in nets. Catching and preparing *Codfish* are important branches of maritime industry; ships are fitted out for the sole purpose of taking them, and so numerous are they in those northern waters, that five and six thousand are captured in the space of two or three weeks.

These fish are prepared for preservation in three differ-

ent ways. When dried in the sun without being salted, they are termed *Stock Fish;* when simply salted, the commercial term is *Green Cod;* but when salted and dried are known as *Dry Cod.* The heads, which are always cut off, are gathered up by the inhabitants of the coast, and eaten fresh, or else dried and salted, and served as food for cattle. The *sound,* or swimming-bladder, supplies an excellent isinglass. The liver is suffered to become slightly decayed, and the oil, known as *Cod Liver Oil,* is expressed, which in many respects, and for most purposes, is preferred to the common sperm oil. The roe is salted and used as bait in catching sardines. The number of eggs these fish produce is incredible; four millions have been counted in one roe.

The *Hakes* (gadus merlucius), are only two feet in length, very slender, and quite as abundant as the cod. They are extremely voracious, and are usually found in pursuit of herring and mackerel shoals. The flesh is prepared like that of the cod, but less esteemed; when salted and dried it also receives the name of stock fish. The back is gray, white on the sides, and so abundant that a thousand are often taken in one night.

The *Haddocks* (gadus æglevinus) are very numerous in the northern seas; from two to three feet long; brownish above, silvery below; generally found within a mile from the coast, and lives on shell fish, crabs and herrings. They are taken as follows: a great number of hooks baited with sea worms, are fastened on a rope nearly a mile long, and kept afloat by means of an empty tun; they seize the bait, and are thus captured. Their flesh is white, solid, and very palatable; there is a smaller species called the *Dorsch* (gadus dorca).

The *Lings* (gadus lota), plate 21, fig. 5, are com-

monly one foot long, and weigh two pounds; their skins are without scales, and slimy, like the eel; marbled black and yellow; the heads are broad and frog-like. They are the only fishes of the Gadoides, that ascend rivers into fresh waters, where they hide in holes and under stones, lying in wait for their prey, which they find in small fish or water insects. Winter is their spawning time; the young grow very rapidly; are by no means tender, and very tenacious of life; can be kept alive in troughs of fresh water, if fed on the viscera of animals. The flesh is white, has but few bones, and is very palatable.

The most remarkable of this order are the *Pleuronectes*, which comprises what are called *Flat* fishes, and have the body very much compressed laterally, and proportionally elevated vertically; never swim perpendicularly, but always on one side. Both eyes are placed on one side; the nostrils on the opposite; they have no swimming-bladder, therefore they mostly lie on the bottom. They feed on snails, crabs, and worms.

The principal of this family is

The *Turbot* (pleuronectes maximus) is about eight feet long, and weighs two pounds; brown, marbled with yellow. The manner of fishing for turbot is either by spearing the creature, as it is seen lying on the bottom, or with hooks baited with lampreys. The flesh is very good.

The *Flounders* (pleuronectes flesus) are over a foot in length, greenish-yellow and black, are found in the northern and eastern seas, and often come into the neighborhood of large rivers, where they bury themselves up to the head in sand. They are hardy, and will bear a transportation of many miles without injury.

The *Sole* (pleuronectes solea) has the shape, and is about the size of a common shoe sole. The color is an olive-brown; is rather abundant throughout Europe, and found mostly at the mouths of rivers.

The other genera belonging to this order are

The *Lump Fish* or *Sea Owl* (cyclopterus lumpus) is remarkable that the ventral and pectoral fins are united in the form of an oval and concave disc; this is composed of movable plates, by the assistance of which the animal can attach itself with vast force to anything that it pleases to adhere to. It is about a foot and a half in length; broad, dark gray above, yellowish below; lives on mollusca, and is, itself, the prey of rapacious fishes. The flesh of the sole is very palatable, therefore it is preferred as being chief of the family of Discoboli.

The *Sucking Fish* (echeneis remora) is wedge-shaped, has a viscid skin without scales, and remarkable for a kind of disk, which covers the head. This is composed of a number of movable cartilaginous plates, by the assistance of which it can attach itself to different bodies. It was once believed that this fish, by its peculiar power of suction, was able to arrest the fastest sailing vessel in its course. Its flesh is not eaten.

FOURTH ORDER.

MALACOPTERYGII APODA, OR SOFT-FINNED WITHOUT ABDOMINALES.

All the fishes of this order have an elongated, serpent-like form; are slightly scaly, with skins which are thick, soft, and viscid.

The *Common Eels* (muræna anguilla), plate 20, fig. 5, have a snake-like form, are about four feet long, and sometimes weigh above six pounds. Their color is blackish-green, and they are found in all rivers and lakes in Europe and America; more abundantly, however, in the northern than southern climates. By day they keep buried in the mud or lie concealed in holes, which they excavate near the shore; these are extensive and have three openings. At night they issue forth in search of prey, which consists of worms, insects, small fish, spawn, and even carrion. In wet weather they occasionally make some journeys on the land, for instance, into pea-fields; by taking advantage of these times and strewing the shore with dry ashes, through which the eels crawl with great difficulty, they are easily captured. In the spring they abandon their fresh water homes and go to the sea, where they deposit their eggs. During winter they bed themselves in holes, and continue throughout the cold season in a state of rest. Several hundreds are often found together. The usual manner of catching eels is by having a kind of basket at the end of a mill-race. The so-called fish-basket is thus arranged: some beams are laid obliquely in the bottom of the stream, the ends of which lead to the basket at the end of the race. The eels crawl mostly on the bottom, and thus, instead of surmounting those beams, pass easily into a snare. Their tenacity of life is remarkable, and when full grown, they are so strong, that, it is said, a stroke from one of them can break a man's arm. As they are very hard to hold on account of their slippery skins and great agility, it is necessary to rub the hands in dry ashes and seize the fish by the head and tail and bend the two extremities together; thus they can not strike. The flesh of the eel

is esteemed by many as palatable, and commonly used as an article of food.

The *Sea* or *Conger Eel* (muræna conger), about six feet long, is gray, thick as a man's arm, has a large mouth with sharply-pointed teeth, and inhabits the European seas. It preys upon snails and crabs. The flesh is eaten and much esteemed. A smaller species, white, and marbled with black, is

The *Muræna* (murænæ), which was so highly esteemed by the old Romans. Vidius Pollio, a friend of the Emperor Augustus, but a monster of barbarity and a great epicure, used to have his slaves thrown into the eel vats to be devoured by the murænæ, and insisted the flesh was greatly improved by the banquet on human flesh.

The *Electric Eel* (gymnotus electricus) is without scales and wanting the dorsal fins; the head is flat and frog-like; length, from two to three feet; color, dirty-brown, thinly spotted with yellow. It has, especially when irritated, the power of giving severe electric shocks, which are sufficiently potent to kill a horse, and as the benumbing shock of this singular creature is transmissible by water, a journey in which the traveler has to wade through fords, is rather dangerous. When it has given repeated shocks to animals or fishes, it becomes exhausted, and requires a period of rest before it regains its electric power. At this time, by means of silken lines, it can be taken without danger. It is found in the fresh water streams and lakes of South America, and feeds on all kinds of fishes, which it first benumbs with its electric stroke. The flesh is eaten and considered good.

The *Tobias Fish* (ammodytes tobianus) is smooth, silvery, brownish above, about a span in length, and

found in the lakes of Europe. It buries itself in the sand to search after worms. Its flesh is bad. A popular belief is, that it is the fish whose gall was used to restore the sight of blind Tobias.

FIFTH ORDER.

LOPHOBRANCHII.—NEEDLE FISH.

Are small, almost fleshless, and remarkable for the mail-like plates which cover their bodies. The principal genera belonging to this order are, first

The *Hippocampus* or *Sea Horse* (syngnathus hippocampus), plate 20, fig. 2, which never exceeds ten inches in length, is covered with rugged lamellæ, dark green, spotted with brown and black; after death the color is altogether brown. The head and tail are curved so as to resemble that of a horse in miniature. It is found in every sea; and on account of its singular conformation, is preserved in cabinets and museums. The flesh is never eaten.

The *Sea Dragon* (pegasus draco), plate 21, fig. 1, is, like the former, covered with small horny plates. The body is angular and large; the pectoral fins are wing-shaped; the color bluish, and the knobbed lamellæ brown. The length of the body is four inches, and it is a native of the Indian seas.

SIXTH ORDER.

PLECTOGNATHI OR BULLET FISH.

This order is distinguished by the globular form of their bodies, and is divided into two families, one of which is easily recognized by being clothed in a kind of mail; the other is smooth-skinned.

The *Moon Fish* or *Cephalus* (orthragiscus mola) has a tail so short and so high vertically that it looks as if the head was cut off. It is without scales, but rough-skinned; the color is shepherd's gray; has no fins, and being so large and unshapely, as its weight is often a hundred pounds, it resembles a floating millstone to which it has been compared. Its flesh is very white, but in boiling dissolves like lime, and has an unpleasant taste. The fat is used as train oil.

The *Porcupine Fish* (diodon hystrix) is cylindrical, about one foot in length, and covered with spines or prickles, and if excited, has the faculty of swelling itself up like a balloon by swallowing air, and when the skin is thus distended, the spines, with which it is armed, become everywhere erect and bristle over the whole surface of the body. These fishes assume this appearance when taken by hook and line, and understand how to use these weapons of Nature's providing as means of defense. They are found in the neighborhood of the Antilles.

The *Petrodon* (petrodon hispidus), plate 20, fig. 7, is one foot and a half in length, of a blue-gray color, with spots of lighter shade, has four stripes of brown on the sides, and four transverse bars of blue. It has the power of inflating itself like the diadon, and wounding

with its prickles. It is sometimes called the balloon fish. It is found in the Nile and Red Sea; being rarely met with, it is treasured as a great curiosity.

The *Trunk Fishes* (ostracion triqueter) are about a span long, the head and strangely-shaped body is of a brown-red color, and covered with an inflexible coat of mail, composed of hard hexagonal scales or plates; they live on crabs and shell fish, are found in the East and West Indies. The flesh is very palatable, and brings a high price. There are others of the same family, which are said to be poisonous.

SEVENTH ORDER.

CHONDROPTERYGII.—CARTILAGINOUS FISHES.

Branchis Liberis or Sturiones.

The fishes of this family have, instead of bones, only cartilages, but they resemble other tribes in the disposition of the gills, which are furnished with an operculum, but the posterior portion of the branchial are free.

The *Sturgeon* (accipenser sturio) is from six to eighteen feet long, of a blue-gray color, and has upon its rough skin five rows of bony, spiny plates; under its pointed muzzle are a few cirri. It is found everywhere in Europe, and, living only in large waters, ascends to a great distance the rivers that flow into the Caspian Sea. In the seas it feeds on herring, mackerel, and shell fish, in the rivers on carp. It is a lazy fish, lying so still and passive in the net that the fisherman passes a cord through the gill openings and mouth without any trouble. Some-

times, however, it is roused to resistance, and inflicts severe and dangerous strokes with its tail. In autumn the sturgeons repair to certain places in the rivers, where they lie packed in rows, ready for their winter's rest. The Cossacks take advantage of their half-dormant state, and cutting holes in the ice, drag the frightened creatures from their lair with long grappling irons or hooks. The flesh of the sturgeon is much esteemed; it is cured with salt and sent abroad. The roe and swimming-bladder, furnishing the commercial articles of Caviar and Ichthyocolla, are in great request. The roe, prepared in a particular manner, salted and packed in casks, is known over Europe as a highly-relished viand by the name of Caviar; an inferior sort is pressed into cakes and dried in the sun. The sturgeon is highly useful to man, for not only are the well-tasted flesh and roe considerable articles of trade, but also the isinglass made from the swimming-bladder is useful for many purposes. It is prepared by cutting, washing, and drying the bladder, then rolled together in the form of ♌, is ready for exportation. Much resembling the sturgeon, is

The *Huso* or *Isinglass Fish* (accipenser huso), over two fathoms long, often weighing ten quintals; is black above, brownish on the sides; the flesh and roe are very inferior as articles of food; the swimming-bladder, like that of the sturgeon, furnishes the valuable commodity called isinglass; also when boiled with sugar-candy, it is used as mouth glue. The smallest species of this species, is

The *Sterlet* (accipenser ruthenus), plate 20, fig. 3, which seldom exceeds two feet in length; the upper surface of the body is black, the under white, spotted with

rose color; frequents the Caspian Sea. Its flesh and and caviare are preferred before the others.

The last of this order, called

The *Ape Fish* (chimæra monstrosa) is the most singular-looking of all the fish tribes. The muzzle is obtuse and inclined upwards; the upper lip is cleft in the manner of what is termed a harelip, and has a number of folds and borders. The eyes resemble those of a cat; the tail is long and very thin, and directly in front of the first dorsal limb is a kind of saw-like fin, composed of sharp spines. Its length is about four feet. The flesh is bad.

EIGHTH ORDER.

CARTHLAGINOUS FISHES WITH FIXED BRANCHIÆ.

This order (Chondropterigii) instead of free branchiæ, protected by a single covering, have them adherent to the integuments, and on the sides of the neck are many openings, which lead to the gill arches. To these belong

The Sharks (*Squalides*),

Which are among the largest; their mouths are planted all over with teeth; these, formidable from their numbers, are also, for the most part, lancet-shaped and indented. Mouth and nostrils are directly below the pointed muzzle; the skin is either entirely smooth or studded with a multitude of small, stony tubercles, and

when prepared, is known as shagreen. Some of them are ovo-viviparous, and bring their young living to the world; others lay eggs, covered with a coriaceous or leather-like skin. These eggs are oblong, angular, and have a membraneous integument on the corners as though wound round with threads. The young, however, are mostly developed before the eggs are laid.

The *Giant Shark* (squalus carcharias), plate 20, fig. 6, is the largest and most formidable of the tribe; about four fathoms long; has four hundred teeth, which are notched on the edges; these terrible instruments, placed loosely in the mouth, the animal has the power of erecting or depressing at pleasure. The shark harbors mostly in the southern seas, and swallows everything that comes in his way; is often seen to follow after ships, and, being very gluttonous, seizes upon all articles thrown overboard, and, as it swallows whatever comes in its way whole, is easily taken by a bait. The manner of catching this huge fish is by means of a great hook enveloped in a piece of beef, pork, or putrid meat of any kind; this, fastened to an iron chain, is dropped into the sea, in the neighborhood of where a shark has been seen; an iron chain is chosen instead of a rope, as the fish would quickly bite the latter in two. The voracious animal approaches the bait, surveys it at first cautiously, but at last darts at it and swallows hook and all; but when he finds the hook lodged in his maw, he seems to turn his stomach inside out, and to disgorge it. After a fearful battle, during which the enraged animal lashes the water into foam in his fruitless efforts to escape, the sailors meanwhile piercing him with spears and grapnels, he becomes exhausted, and suffers himself to be drawn on shipboard, where he is soon dispatched. The flesh is not good; the

fins, however, are eaten; train oil is made from the liver, and the skin, converted into shagreen, is used to cover instrument cases.

In the last century, it is said that a sailor exhibited as a show, a stuffed shark, by which he had been swallowed whole, without being wounded by the teeth, and was disgorged on a cannon being fired. The fish, of which the well-known story of having swallowed the prophet Jonah is told, was most probably the giant or *White Shark*. When this terrible creature is about to swallow his prey, he is, on account of his projecting muzzle, obliged to turn on his back, and as some time is required to perform this operation, it is possible for a bold swimmer not only to escape, but to engage in battle with him. There is a story told of a sailor who in this manner revenged the death of his brother. The young man, in bathing, ventured too far from the ship, and was swallowed by a shark; the brother, aware of his fate, at once armed himself with a short sword, and boldly threw himself into the sea, where the shark, soon discovering the new prey, swam swiftly towards him. The sailor, no less resolute than active, calmly awaited the arrival of the monster, which, turning on his back, made ready to swallow him. At this critical moment the young man dived quickly below the shark, and gave him a deep wound with his sword. The enraged enemy now turned, opened his huge mouth, and tried to conquer his antagonist, either by swallowing or killing him by a stroke from his tail. But the sailor dexterously avoided both, and succeeded at length in killing his formidable antagonist with repeated wounds of his sword.

The *Saw Fish* (squalus pristis) has on its snout a

long smooth sword, armed on each side with strong bony spines resembling teeth. This beak, from which they derive their name, is not unlike a carpenter's saw, and proves a powerful weapon in the frequent battles it maintains with dolphins and whales; these contests are fearfully violent, and obstinately continued until death decides the victory. The saw fish is mostly conqueror, as he thrusts his formidable saw into the vitals of his victim. The whale fishermen watch these battlings with much interest, and, when ended, pursue the saw fish, which not seldom breaks his saw. This fish is about fifteen feet in length, dark gray, and smooth. Their true teeth are small, and look like a pavement made of pebbles, therefore it is probable that they live principally on crabs and shell fish.

The *Balance Fish* (squalus zygæna), plate 20, fig. 8, has a body and fins resembling those of the shark, from which it is sometimes called the *Hammer-headed* shark, from the peculiar form of its head, which has a singular prolongation on each side, resembling a hammer, on which the eyes are placed; the teeth are sharp and triangular. Its length is often that of a man, sometimes greater; is rough, gray, and lives mostly in the Mediterranean, preferring muddy spots. It is viviparous, producing about a dozen living young; very rapacious, and the flesh not particularly good. A scarcely less numerous race is that of

The Rays,

Recognized by their flattened bodies and long slender tails. The mouth lies under the long muzzle, the small eyes above, on the head; and behind these are two bran-

chial openings. The eggs, like those of the shark, are angular, brown, and leather-like; the long point, however, is wanting. The flesh is white, tender, and much esteemed. The most remarkable is

The *Torpedo* or *Electric Ray* (raja torpedo), which has a smooth round body, without spines, and of a dark color, with a few spots, like eyes; its skin is very slimy. The rays have the power of giving electric shocks, like the *Gymnoti*, and it is believed they use this faculty to benumb and thus obtain their prey. The shock, however, is less powerful than that given by the electric eel. They seldom exceed a foot in length; the flesh is slimy, and not valued.

The *Skate* (raja batis) generally measures two feet; the body is rhomboid; gray, spotted with black; rough, but without spines, except a single row on the tail. It is found in every sea, but principally in the northern waters, where it is taken, and after being boiled in seawater, the flesh is considered by the inhabitants of those regions as very palatable food.

The *Thornback* (raja pastinaca) is one foot long; olive brown; smooth and viscid; in the middle of its slender tail is a sting, three inches in length, doubly dentated, with which it can inflict very dangerous wounds, and from which it is sometimes called the *Sting Ray*. The American Indians use this sting as barbs for their arrows; and it serves the fish as a weapon of defense, or in taking their prey. The thornback is found in every sea, and was known to the ancients. The sting is considered poisonous by the common people, and the fishermen cut the tail off immediately on taking the fish, lest they should be wounded.

The *Giant Ray* (raja cornuta) is very large, and the

pectoral fins rise up like two immense horns. It is found in the southern seas, and is known to the sailors as the *Sea Devil.*

The Lampreys

Have elongated bodies, like worms; the mouth is circular, something resembling a bowl, and armed with several ranges of small teeth.

The *River Lamprey* or *Nine Eyes* (petromyzon fluviatilis) is about a foot in length, and as thick as a man's finger, and has many wrinkles in the skin, which is dark green and silvery. Lampreys are found in all the muddy brooks of Europe, but are particularly abundant in England and north Germany, where they are taken in millions. They are eaten raw, or broiled; or, preserved with spices and vinegar, are sent abroad as an article of commerce. Those taken in winter are so superior that no one will fish for them in summer. The *Courland* lampreys are considered the best. They feed on worms, water insects, fish roes, and decayed flesh.

The *Sea Lampreys* (petromyzon marinus), plate 20, fig. 4, are more than two feet long, and as thick as eels; are marbled yellow and white. These fish have the extraordinary power of attaching themselves so closely to solid bodies that a twelve pound stone to which they may be suspended by suction, can be raised easily with them. They are found in all the seas, but more abundantly in the eastern and northern. They ascend the rivers in spring, which is their time for spawning; their flesh is then very good, but after May is not fit to eat. They are eaten broiled, as eels, but are also marinated and sent abroad. They are more rare, and on that account dear.

The *Hag Fish* (myxine glutinosa) is worm-like, and without eyes; the upper margin of the mouth is pierced by a spiracle; it measures nine inches in length, is thick as a finger; bluish, and very slimy. The myxine is found especially in the Baltic, in the loam at the bottom, doing great injury to the fishes on which it attaches itself, and piercing a hole in the skin, using its mouth as a cupping-glass, and sucks away the flesh, leaving nothing but skin and bones. Their bodies are covered with a white viscid mucus, which, when placed in a vessel of water, is thrown off in an incredible quantity.

The *Querder* (ammococtes branchialis) is about eight inches in length, looks like a large maw worm; is frequently found in small brooks and rivers in Europe and elsewhere; is fond of harboring in the flax which is placed in the water to be cured; it is eatable, but on account of its vermicular appearance, is used only as bait. It is sometimes called the *Line Eel.*

The observant reader, who has followed us through the graduated scale of being to the present point, will doubtless have remarked how wonderfully the links of the chain of animation have lessened as we advanced in our description. Man, whom we began with, and the most wonderful of all animal structures, stands at the head of all mammals, and, independently of his possessing an immortal soul, is the most complete and most wonderful of all animal structures. By his external qualities alone, he stands at the head of the great class of all living beings; and it may have been observed, as we descended the scale of animation, that the animals become less and less perfectly organized; the nervous system, the respiratory and circulatory processes grow less and less perfect as we proceed. In the variety and progres-

sion which reigns throughout, we discover, on reaching the reptiles, that their heart has lost one ventricle, and their blood is cold; and in fishes we find it has lost an auricle, and consists only of a single auricle, and a single ventricle. In the fishes, also, there are striking changes in the composition of bone; the skeleton gradually loses its hardness, until we come to the Myxines, where it is soft and membraneous, or, it might be said, "the internal hard frame called the skeleton has disappeared, and we are brought step by step to the consideration of soft animals without vertebræ; but, nevertheless, they are provided with organs suitable for maintaining the kind of life with which they are endowed by the Omniscient Creator of all things." This concludes our account of the *vertebrate* animals which constitute the *First Branch* of the *Animal Kingdom*. We will now consider the *Second Branch*, composed of *invertebrate* animals, at the head of which stands the *Mollusca*.

CLASS V.

CONCHOLOGY.—MOLLUSCA.

This class is distinguished from the other higher classes by having no bony skeleton which may serve as a solid foundation for supporting the soft parts, as is the case in all the classes already described. Their bodies are soft and slimy, hence their name; and, for the protective covering of what else would be so defenseless, they are provided with a chalk-like shell, that serves to guard them from contact with the external world. They have cold, white blood; many breathe through organs resembling gills, and in a few, the common snail, for instance, respiration is carried on through sack-like lungs.*

In most other living creatures, the head, trunk, and

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* The lungs of reptiles consist of a number of bags of membraneous texture, into which the air is conveyed. Most of the mollusca respire by means of gills, which, although they differ in some measure from those of fishes, are formed on the same plan. In some instances they respire air by itself, but in general by the medium of the water alone. In some animals of these classes the gills are situated upon the outside of their bodies, but commonly within. Zoophytes have no distinct organs for respiration; yet the air seems, in some way or other, necessary for their existence also, and probably penetrates and acts upon their blood by means entirely unknown. These animals are all cold-blooded.—Nat. Phil.—*Tr.*

limbs are easily recognized, because their organization approaches more nearly that of the mammalia. In the most of the mollusca such an arrangement of organs is not apparent; and it requires an experienced eye to discover and decide what is the head, trunk, or feet. Their bodies are generally covered by a fold or reflection of the skin, which envelopes them completely, and is called their mantle; sometimes this covering is membranaceous, or partly fleshy, but in most cases is composed of a stony matter resembling carbonate of lime. This envelope serves to protect the soft parts of their bodies, and in many of the crustacea exhibits most beautiful varieties of form and color. This order is divided into two classes, partly from their organs of motion, and partly from the form and structure of their shells. The following table will give an idea of their classification.

FIRST ORDER: .. CEPHALOPODA.—The feet or tentacula go out from the head; somewhat resemble arms, and are furnished with cups or suckers; the *Cuttlefish* belongs to this order.

SECOND ORDER: GASTEROPODA.—Includes those mollusca that have the soft portions of the body inclosed in a shell, consisting of many convolutions, and the feet, or instruments of motion, are placed in the form of a fleshy mass under the belly. The *Snails* belong to this order.

THIRD ORDER: .. ACEPHALA.—The mollusca belonging to this class have no distinct heads; neither can trunk or limbs be distinguished from the general mass. This order includes all the bivalves, such as *oysters, clams,* etc.

FIRST ORDER.

CEPHALOPODA.

This class is composed of mollusca of rather fantastical shapes. Their round, thick bodies being enclosed in a kind of sack-like mantle, out of which the head, furnished with two large eyes, is distinguishable. The mouth, which much resembles the beak of a parrot, is the organ by which they take and hold their prey, and around this opening are a number of flexible and fleshy appendages, like arms, of which two are mostly longer than the rest. On these arms are found suckers not unlike cupping-glasses, by which they fasten themselves on their prey while they feed upon it. When the head is drawn back, the creature is entirely enveloped in the mantle, the tentacula only appearing. They have also, under this mantle, one bone, which, externally, is very hard, but inside is perfectly soft. Many of this class are furnished with shells, which, however, cover but a small portion of the body. They have also within the cavity of the abdomen, a kind of pouch connecting with glands which secrete an ink-like fluid; this fluid, the animal has the power of ejecting at pleasure, and when in danger or approaching its prey, pours it out so abundantly as to discolor the water, and render itself invisible. This is a maneuver imitated by men in various ways.

The *Cuttle Fish—Ink Snail* (sepia officinalis), plate 26, fig. 3, is a span long; the body about as thick as an arm, with eight small, and two large arms. The white fish bone (os sepiæ) used in the arts as a pounce and for polishing, is produced by this animal, which is found in all

the waters of Europe, but more abundantly in the Mediterranean Sea. It is eaten, and a sauce, considerably esteemed, is prepared from the dark juice. By means of its suckers the cuttle fish affixes itself strongly on fishes marked out for prey, but it is not dangerous to swimmers. There are many relative races; many are of immense size, and have arms twelve feet long; these are rather to be dreaded, as they can drag a man under water. One of the handsomest families of the cephalopod race is that of

The *Argonaut* (argonauta argo), which much resembles the cuttle fish, except that on the two longest arms is a membraneous skin resembling a sail; but it has a still more distinguishing mark in its delicate and beautiful shell, which, white and thin as paper, has obtained for it the name of the *Paper Nautilus;* but the greatest peculiarity of all is the spreading of the little sail on their long arms. Men insist they expand it to catch the flying gale, using their shell as a boat, and their long arms as oars. It is probable that the last supposition of the nautilus using its arms for rowing is true, but it does not employ its shell as a boat, as the latter is placed loosely in the former, and without adhesion, is sometimes unfit for sailing, and deserted entirely.

The *Nautilus* or *Sailor* (nautilus pompilius). This cephalopoda has a very beautiful mother-of-pearl-like shell, which, in the volutes or whorls, resemble those of a ram's horn. It is also vulgarly termed *Horn of Ammon*, because the shell, like those of the Ammonites or snails, is divided into many chambers. The animal has its seat in the exterior one, but there is a tube issuing from the posterior portion of the animal's body, which traverses all the other chambers. The beautiful

shells of the nautilus were used in early times as drinking cups, ornamented with various devices, and found in all large assemblies. Little is known concerning the habits of the nautilus.

The larger species of the cuttle fish race in early times were objects of dread to the ancient mariners, and are the foundation for all the marvelous stories of the *Kraken*, which is represented as a gigantic mollusk, that could grasp a ship in its long arms, and drag it to the bottom. The *Ammonites* (snake-stones), *Belemnites* (thunder-stones—nautilata), now only found in a fossil state, belonged also to the class of cephalapoda.

SECOND ORDER.

GASTEROPODA.

Mollusca of this class crawl by means of a fleshy mass which covers the lower surface of the abdomen; the back is furnished with a mantle, which can be more or less extended or compressed, and is of various forms, but mostly assumes that of a spirally-twisted shell. The head is plainly developed, and in most appears to be very strong; the mouth is surrounded with feelers, which they are constantly using; the eyes are very small, and, in some, entirely wanting.* The calcareous envelope, which is formed by the enclosing mantle, increases in size every year, and more or less resembles a spirally-

* Many of these animals are entirely naked; others have an internal shell concealed in the thickness of the mantle; but most of them have an external shell, which is almost always sufficient to contain them entirely and afford them protection.—Nat. Phil.—*Tr.*

twisted cone, whose single involution rolls or winds around a small column in the interior. Many of the same have an opening at the foot, which serves to close the entrance of the shell, when the animal retires into it. This is the case with the aquatic snails (pulmonea aquatica). Some of these snails breathe the air through a kind of lungs, others have a branchial apparatus. To the pulmonea, or those having lungs, belongs

The *Common Red Slug* (limax rufus), which is without a shell, the body is almost cylindrical, about the size of a man's finger in length and thickness; the color is reddish-yellow above, gray below. They are especially abundant after rain, and are found always in damp places, such as moats and ditches. They lay from twenty to thirty small eggs; these, covered with a parchment-like skin, are deposited under stones, etc. Some few are black. They are supposed to show the state of the weather in the following manner: If they are seen crawling homewards in the evening with mud on their tails, bad weather may be expected; but if they carry a green leaf, the weather will be fine. They feed on all kinds of plants and refuse matter.

The *Field Snail* (limax agrestis) is one inch long, of a foul white color, very slimy, and most injurious to agriculture. Ducks are kept by many on account of their useful services in ridding the fields and gardens of these slugs.

The *Vineyard Snail* (helix pomatia) has a body resembling the above described, which is enclosed in a shell resembling a twisted cone. These snails are found everywhere, in meadows, gardens, or about hedges, and towards the latter part of summer appear in great numbers. They can be fed on cabbage, salad, clover, etc., so as to be

made very fat; on the approach of winter they retreat entirely within their shell, the mouth of which they close up with a kind of calcareous substance. Thus enclosed, and safely embedded in the earth or in hollow trees, they remain torpid until spring. Whilst thus voluntarily imprisoned, they are used as food, and being boiled in salt water, are considered as being both savory and wholesome. They deposit their eggs, which are about as large as peas, during the summer season, in cavities of the earth. A great variety of snails, larger or smaller, some with flat, others with spiral, or oblong shells, are found in gardens. They are so numerous as to be considered as pests, and do great injury to vegetables, without being useful in any possible way.

The *Midas Ear* (bulla hæmastomus) is three or four inches long and two inches in thickness. It is found in the forests of Brazil. In many places these snails are valued on account of their shells, which are of a pale-red color and very thick, and are used by the lime burners. The eggs are as large as those of a pigeon. Another of the species, very large, and the handsomest specimen of the terrestrial snail, is

The *Zebra Snail* (bulla zebra), the shell of which is five inches long, white, with brown spiral stripes, and found only at the Cape of Good Hope.

The *Common Water Snail* (helix stagnalis) abounds in all our pools, and may be seen swimming on the surface of the water. The length is about one inch and a half. They are sometimes kept in glass jars, and fed on duck weed, etc. They lay their eggs on water plants, and the shell or covering is so very transparent, that the movements of the young snail enclosed within, are clearly discernible.

Branchial Snails.

First of this class is

The *Turbo* (turbo scalaris), which is snow-white, about two inches long, with shells having the whorls of the spire so far apart that they touch only on the extreme edge of the aperture; this extremity is formed by the border of the mantle, and completes the whole. The spire is concave. This snail is a native of Ceylon, and one hundred years ago was so rare, that a single one would sell for five hundred florins, and at present the usual price is ten florins. It is sometimes called *Wendeltreppe* or *Winding Stair*.

A species of Turbo is found in the Mediterranean, which, although resembling the genuine, is not the turbo preciosa above described; the whorls of the spire are closer together, which forms a distinguishing characteristic.

The *Pagoda* (turbo pagodus) is about two inches long, the same in breadth, of a gray color, and furnished with projecting ribs, which gives it a resemblance to a Chinese roof. This snail can not live under water, but hangs on rocks against which water dashes, and is so tenacious of life, that it can live a year without food or drink. Its only aliment is supposed to be the slime collected on the rocks by the dashing of the spray. It is found by all the streams in the East Indies; its flesh is bad.

The *Giant's Ear* or *Oil Jar* (turbo olearius) is two hands' breadth in thickness, is rough and horny on the outside, gray, spotted with green and brown. The shell inside is like mother of pearl; it adheres so closely to

the steep crags where it lives and is so strong that it can not be taken from its shell.

The *Wrinkled Roundmouth* (turbo rugosus), plate 25, fig. 2, is about two inches long, rough, and traversed with lines of green. Found in great numbers in the Mediterranean Sea.

The *Marbled Cone* (conus marmoreus) has a conical shell, the spire of which is so short that it can be placed upright. It is about three inches long, one and a half in circumference, black, with numerous triangular white spots, which give it the appearance of being covered with delicate network. Their eggs resemble a pile of coarse cords, and are eaten as well as the snail itself. It is found in the East Indies, where they use the shell for ornamental purposes, such as making rings, etc. Much resembling the above-described, only having a longer spire, is

The *Pointed Cone* (conus acuminatus), plate 25, fig. 8. The shell is reddish-white, waved with many fine lines; is found in the East Indies, but is very rare. There are many others of the genus conus, which are remarkable for the brilliant beauty of their colors.

The *Bishop's Cap* (volvaria episcopus) is about five inches in length and one in thickness, smooth, white, and marked with square spots of a red color; it is found in the East Indies, and inflicts dangerous wounds with its muzzle.

The *Tiger Porcelain Snail* (cypræa tigris) differs from all other snails in having the shell arched above, and a notched aperture below. Its length is four inches, circumference three, very smooth like porcelain, of a bluish-white, dotted thickly with dark brown; a stripe of light brown runs across the back. This beautiful mol-

lusk shines or glances in the sea like glass, and is valued more or less as the blue tint predominates; for the most part it lies buried in the sand, coming forth only at night at the times of the new or full moon, when it attaches itself to the rocks. They are killed by putting them in hot water, and then, as the remains of the creature can not be removed from the shell without injury to the latter, it is laid in the shade near to an ant hill, so that the busy little emmets, which will be sure to enter it, may feed upon the carcass. If placed in fresh water, the colors fade while the decayed mollusk remains within the shell, but when desired in great brilliancy, the hue can be restored by laying it occasionally in salt water and drying it in the sun. The porcelain snail is poisonous. There are others of this genus which are distinguished by having the aperture notched on one side only. The most remarkable of this sub-family is

The *Hen's Egg* (bulla ovum), three inches long, two in thickness, smooth, and milk-white; the snail which occupies this shell is black as pitch and poisonous. There are several races of the Cyprea Porcellana, some of the smallest of which are used by the uncivilized East Indians as coin (cowries).

The *Harps* (buccinum harpa) are over three feet in length, two in breadth, oval above, and have sharp broad ribs, which project and somewhat resemble the strings of a harp; the color is white, dappled with red, and glances with a beautiful luster. The ribs are flesh colored, and marked between with brown and white squares, somewhat like panes of glass in church windows. The flesh of the enclosed snail is hard and gristle-like, and in front is a fleshy appendage, which can not be drawn into the shell. The creature has the power of detaching itself from this

leaflet or mantle, and leaving it behind. When confined in a vessel containing water, if an attempt is made to take it, it crawls rapidly round and fills the water with slime, but the moment it is touched, it draws back into its shell, leaving the fleshy appendage already mentioned to float or sink as prize to the captor. It is a native of the Indies, and considered poisonous.

The *Trumpeter* (murex tritonis) is above a foot in length, and as thick as a man's arm, with transverse elevations in form of short varices or ribs on the shell, which is spotted with white, red, and brown; at the mouth it is smooth and red. The snail itself is wrinkled, and looks like the neck of a frog. Its color is spotted red and brown. The flesh is eaten. If the mouth of the shell is placed to the ear, a kind of rushing sound is heard; this noise, supposed to resemble the murmur of the sea, is observable in many of the Conchifera, but more particularly in the murices. The shells of this species are used as trumpets by the natives of Tartary and the East Indies; a small piece being removed from below, fits them for sending forth tones which may be heard at a great distance. In order to retain their luster it is necessary to place them in salt water, every two years.

The *Pelican's Foot* (rostellaria pespelecani), plate 25, fig. 5, instead of a regular spiral shell has strong projections issuing from the sides. Its length is two inches, its breadth about the same, and of a brownish-gray color. This tribe of mollusca are frequently found in the Mediterranean, where they are easily taken in the time of storms, as they then creep out of the mud. The flesh is eaten, and considered good.

The *Sea Ear* (haliotis canaliculata), plate 25, fig. 3,

is rather oval, turbinated only on the posterior portion, and furnished on the outside with projecting folds (plicæ) and warts or knobs. Along the columella or right hand border is a series of holes, through which the water reaches. Its length is above three inches, its breadth two, internally covered by a layer of mother-of-pearl, and on the outside is of a grayish-green color striped with red. It is found on almost every sea coast, where it clings to the rocks, adhering to them closely. It is eatable.

The *Knee Pan* (patella vulgata). All the patella have a broad-based, pan-like shell, without a vertebral spine, that covers the whole body of the broad, fleshy animal within, are found on every sea coast, and adhere so closely to the rocks, that it is necessary to detach them with a knife. The most common is pearl-like inside, two inches long and two high; the shell is whitish-gray on the outside, surrounded by four rows of leaflets or fringes, which are russet-colored. This species, of which there are many varieties, are used as food.

The *Sea Hares* (aplysia depilans) have, instead of a shell, a horny plate or fold which is covered by the mantle, was well known to the ancients, who gave it the name of sea hare. It has an unpleasant odor, and is supposed to possess poisonous qualities. Its form is singular, being drawn up together, so that it somewhat resembles a young hare. Its color is a dirty brown; length from six to eight inches, thickness three. The body is ornamented with spots of a beautiful purple color; if pressed or crushed, a reddish-colored liquid is poured out, which is of so acrid a nature that the hand which it touches, will swell immediately, and if, by any means, a drop of this fluid is brought in contact with the

beard or head, the hair will fall off. These mollusks crawl about on the rocks like snails. The odor, however, is intolerable, whether the creature is brought into the house or thrown upon the strand.

THIRD ORDER.

BIVALVES OR THE TRUE MUSCLES.

This class of mollusca are inclosed in hard calcareous shells, have no distinguishable head; a few of them adhere closely to the rocks, without ability to move from the spot; others have a pedicle or foot, which is a fleshy mass, somewhat resembling the tongue of a mammal, and can be protruded outside of the shell, and serves for motion along the bottom of the water; the progress, however, of all this class is slow. When waiting for food, the bivalves open their shells slightly, but no sooner does a worm or other eatable article come within reach, than the shell is again tightly closed. On the approach of an enemy the same sudden shutting up of the defending shell is observed; and when taken from their native waters, they keep so tightly closed up, that not a drop of the liquor usually found inside can escape. A few of them spin, it is imagined, with their foot a bundle of silk-like filaments, by means of which, like anchor-cables, they affix themselves to submarine bodies. Those which sit fast on the rocks have no foot. The first of this order,

The *Common Oyster* (ostrea edulis), is somewhat elliptical, about as broad as a hand, and consists of a

number of leaflets or plates of a grayish-white color and folded over each other. The inside of the shell has a slightly iridescent luster, resembling mother-of-pearl. Oysters are found all over Europe, and in Holland are peculiarly fostered. The manner of raising them is as follows: As the young come forth from the spawn from June to the end of August, the oysters are placed in ingeniously-arranged pools, into which the sea water can be admitted at pleasure; here they remain until the young are of a considerable size; they are then removed from the pools and deposited in suitable places along the coast, which are termed oyster-beds, and thus, gaining time to grow, in the course of four or five years attain full size. They are very small at first, being scarcely the hundredth part of an inch. They live, it would seem, for no other purpose but to subsist on such food as they require, and have no means of defense in time of danger except to close their shell. To secure the first, they must wait with the valves unclosed until the desired object approaches; but it appears that they can readily distinguish between their legitimate prey and an enemy, for if it is the latter, the shell is immediately shut up. Three mice were once running about on the strand, where some large oysters were lying, and, attracted by the prospect of a good meal, one approached and thrust its nose within the open shell, which the oyster immediately closed, and did not open again until the mouse was dead. The sea crabs are more cunning; seeing that the oyster closes its shell too quickly for him to effect an entrance, the wily enemy takes a small stone within his claws and thrusts it between the valves of the shell; thus keeping it open, he invades the premises fearlessly and feeds upon

the occupant. Oysters are considered good and wholesome food, but, by most, are preferred to be eaten raw.

The *Cock's Comb* (ostrea cristi galli) is almost triangular, and has strong folds on the border of the shell, which fit into each other; it is very rare, and found only in the East Indies.

The *Neptune's Box* (pecten gibbus), plate 25, fig. 4, is one of the handsomest of the acephala; differs from the other oysters in having the lower shell less concave than the upper, and also by the ribs radiating towards the margin, like the sticks of a fan. Its size is four inches, cinnamon colored, with white and bluish spots; this family, with other relative races, can swim, but in a most singular manner. They open and shut the valves incessantly, and thus give a kind of stroke to the water, which propels them upward and downward, but at each move furthering their course. The Neptune's box (scallop) is found in the West Indies. Much resembling it is the large *Pecten Jacobea* (St. James' cap), about the size of a man's hand, and somewhat resembles a mantle; in the early times it was usually worn as an ornament by the pilgrims who wandered to the shrine of St. James di Compostella, from whence it has its name. All the pectenæ are eatable.

The *Pearl Oyster* (mytilus margaritiferus). The shell is about as large as a hand, tolerably round, of a blackish color outside, and pearl-like or nacreous within. The flesh tastes like that of other oysters, and is commonly eaten. The pearl oyster is found principally in the Persian Gulf, the seas surrounding Ceylon and Japan, and on the coast of Morocco. The pearl is supposed to be formed by a grain of sand, which, having accidentally found an entrance into the shell, has become

changed into a pearl by the same operation of the secreted fluid which acts upon the shell, rendering it nacreous and beautiful.* This supposition obtains generally, as pearls are by no means found in every oyster. In twenty oysters brought up from the depths of the sea, very often not a single pearl is obtained, whereas, on the other hand, sometimes twenty pearls are found in a single one. The manner of fishing for pearl oysters is as follows: the divers, who are very expert, go out in boats at the break of day to the spots where these oysters abound; these boats are provided with stones which weigh from fifteen to twenty pounds, and serve for anchors. To accelerate his descent, each diver seizes one of these diving-stones with his toes, at the same time holding to the rope to which it is fastened, and which has assisted him to go down; this he keeps in his left hand. No sooner has he reached the bottom, than he frees himself from the stone, collects the oysters as rapidly as possible, fills a net which hangs from his neck with them, and gives a signal to be drawn up, as soon as he finds it necessary to take a new inspiration. His mouth and nose are protected by a sponge filled with oil, but it often happens that on coming to the surface blood issues from the mouth, nose, and ears, occasioned by the pressure of air upon their lungs in going down to the bottom. The oysters are put into pens, and there left until the animal matter decays, when the loathsome and unhealthy business of washing the pure pearls from the putrid mass commences. They are then assorted through various

* All shells that are nacreous internally may produce pearls; and it is said that it is not uncommon to find them in a sort of large muscle (unio) which inhabits the great rivers of Europe and the United States.—*Tr.*

sized sieves made of brass. The largest and handsomest, called round pearls, are the most valuable, and sold according to their weight, a single one, weighing but a grain, is sold for a rix dollar (four shillings and sixpence sterling).* The price varies according to their size; ten thousand rix dollars are sometimes demanded for the largest.

There is some labor expended on them before they are ready for sale; many washings are necessary to purify them, and after being thoroughly cleansed they are polished with salt and tripoli, or sulphate of potash. The divers are subject not only to the dangers of the deep, to tempests, to suffocation at the bottom, to being devoured by sharks, but also to severe disease arising from their unhealthy employment of assorting the pearls from the putrid oyster, and few survive more than five or six years.

This class of mollusca furnishes not only pearls as worn for ornaments, but also mother-of-pearl formed from the beautiful nacreous lining of the shell, and the iridescent substance found at the clasp which is known by the name of the *Peacock Stone.*

The *Pinnæ* (pinna nobilis) are a span long; have valves in the form of a half-open fan; about a hand-breadth across; brown outside, but pearl-like within. They have a foot with which they are supposed to spin the filaments by which they anchor; these threads, termed *byssus*, or by some *beards*, are often a foot in length; are strong and brilliant, partly of a gold color, and partly brown. The animal thrusts the sharp end of its shell into

* The revenue of the pearl-fishery of Ceylon amounts annually to $80,000.—Ruschen Voy.—*Tr.*

the sand, and fastens itself by the byssus to the surrounding stones. Fine gloves and stockings are made from these silk-like threads, and in the south of Italy and Sicily, they are employed in the manufacture of precious stuffs; they sometimes contain pearls. It is a popular belief that the pinna lives in close intimacy with a small crab, which warns it on the approach of its most formidable enemy, namely, the cuttle fish.

The *Moss Muscle* (mytilus edulis) is smooth, violet-colored; nearly wedge-shaped; more than two inches long, and one and a half broad; is found in every sea, mostly on sand banks, not far from the shore. The foot is slender, cylindrical, protruding like a tongue, and furnished with a silky byssus, which, spun by the animal, enables it to fasten itself on other muscles. When the mytilus is about to station itself anywhere, it opens its shell, protrudes its foot, and feels around for a suitable spot; this being selected, is covered with an adhesive fluid secreted by the animal; the foot is again drawn back, and a thread spun, and this process is repeated until a sufficient number is produced to serve as steady anchor cords. They are said to possess a flavor superior to that of the oyster, but sometimes occasion a kind of poisoning; they are better to be eaten cooked than raw.

The *Lithodomus* (mytilus lythophagus) is cylindrical, four inches long, and about one in thickness; of dark horn color, with latticed stripes. This muscle is found imbedded in chalk cliffs and other rocks, which it bores into a number of cells, resembling those of a honey-comb. How this is accomplished is wonderful, as the shell of the creature is softer than the rock it perforates, and if by means of an acid, as some suppose, it is as likely to operate upon the shell as the stone. At all events no such

acid is found within the valves, for this species of mytila is also eaten and found very palatable. The lithodomus is met with in all the warmer seas, mostly in the Mediterranean.

The *Chamacea*, of which the principal is the muscle known as the *Nail Shell* (chama gigas),* are white, oblong, with shells usually lamellar and rough, and the largest of the tribe; they are about five feet in length, and so heavy that it requires from six to eight men to carry one. Seen through the opening of the valve, the creature appears hideously ugly; has the semblance of a snake skin full of black, yellow, and white veins. It is dangerous to approach it too closely, for an arm or leg may be the price of such temerity. Divers venture sufficiently near to encircle them with ropes, and in this manner only can they be drawn to the surface; they are considered very good food, and as one is sufficient to furnish a meal for several men, the trouble of taking them is repaid. The Orientals make bathing-tubs and basins for small springs from the shells. This genus belongs entirely to the Indian Ocean, but especially to the coasts of Macassar.

The *Painter's Shell* (mya pictorum), plate 25, fig. 1, about three inches long, and one broad; of an oblong oval form; brownish below, but seemingly rubbed off above. It is found in the mud of all rivers, and, as if fearful of danger, buries itself in the sand with great rapidity. If viewed in a glass, the reception of the water which serves for the nutriment of the body, and its ejection through the small tubes, may be distinctly

* Known by the vulgar name of *The Holy Water Pot.* The shell itself often weighs three hundred pounds.—*Tr.*

seen, and how it is effected by the respiratory process. The *Barnacle* or *Duck Shell* resembles the above, but is larger, and has a more fragile shell, which is, as is well known, used by painters.

The *River Pearl Shell* (mya margaritifera) is black on the outside; the interior of the shell is lined with thick laminæ of beautiful mother-of-pearl; its length is about four inches, its breadth two; pearls are found within the valves, but much inferior in beauty to the Oriental. They are found in the Elbe, the Moldau, and other streams in Middle Germany.

The *Tellina*, Tunkenshell (tellina gari) is oval, two inches long and one broad; gray, rayed with brown. The flesh is white and soft, and the liver being first removed, pickled with vinegar and spices, is much esteemed as sauce. It is met with in all the southern seas, but principally in the Mediterranean.

The *Razor Shells*, *Knife Handles* (solen vagina), so called from their elongated form resembling the handle of a dessert knife, are six inches long, of a green color, striped with red. They are found on the coasts of Europe, but principally on those bordering on the Mediterranean, where they are very numerous.

The *Stone Finger* (pholas dactylus) is over three inches in length, one in thickness, and is striated in a kind of network. The shell is very easily broken, nevertheless, they can excavate tubes or long cells in the hardest wood or even lava, like the Mytilas. The flesh is considered superior to the oyster in flavor and tenderness.

The *Ship Worm* (teredo navalis) has no proper shell, but is an almost vermiform body, about half a foot in length, about as thick as a grub worm, and is celebrated

for the ravages it commits on ships. These mollusca excavate, in submerged wood, holes or tubes, which it lines with a calcareous matter so hard that it might readily be mistaken for a second shell. Vessels have been sunk by the holes bored through their bottoms by these animals, and the only way to guard against their depradations, which they carry on constantly and to such a large extent, is to sheathe the submerged portion of the ship with plates of copper. These mollusca are eatable, and said to be preferrable to the common oyster.

The *Fire Bodies* (pyrosoma elegans), plate 25, fig. 6. This very remarkable family are without shells, and, uniting in great numbers, form a large, hollow cylinder, which, by the alternate contraction and dilatation of the animals that compose it, swims in the water and emits a beautiful iridescent light, seen to great advantage by night. When several of these pyrosomæ are swimming together, they appear like an immense luminous globe, arising from the dark bosom of the ocean. The entire length of the animal is seven inches, the circumference one only. When floating quietly, the color is yellow, with a slight mixture of green, but as soon as it contracts in order to move, a fiery glow, resembling the hue of red hot iron is emitted, and which again fades into the changeful shades exhibited by iron as it cools.

CLASS VI.

INSECTA.—ENTOMOLOGY.

INSECTS are distinguished by having, like the higher classes of animals, a visible trunk and limbs, which determines the general form of the body, and furnishes them with means of motion; it is, however, neither a skeleton, like that possessed by the superior classes, nor a calcareous shell, such as distinguishes the mollusca, but species of horn-like case or armor, inside of which the muscles of motion and the soft parts of the animal are enclosed. This is plainly to be seen on the most superficial observation of the structure of the crab, where the whole animal is enclosed in a species of solid armor, which yet leaves the limbs separate and distinguishable. This mailed covering being removed, the interior is found to consist of muscles, which are of great power, and serve for the purposes of progression and motion. The most of insects are found to possess the following wonderful internal structure, nevertheless it varies somewhat in the different classes: Those which do not breathe through branchiæ, of which the crabs are the only type among the articulata, possess a number of air tubes, or trachea, which ramify like roots in the interior, conveying the air to every portion of the sys-

tem, and makes the greater part of the body appear like a lung. These tubes communicate externally by openings placed on each side of the body, and are termed stigmata. This arrangement of the organs for aerial respiration is plainly discernible in the structure of the naked caterpillar, where the filamentous canals are quite visible to the naked eye, and may be counted. If the body of the insect is covered with oil or varnish, it is at once suffocated; life is even more suddenly extinct than in the severance of the head from the trunk of a human being. The organs of nutrition are variously fashioned, differing according to the nature of the food required by the different races. Some possess strong antennæ or feelers; others have their mouths armed with a sort of lancet-like beak or piercer; and another class are provided with a tubular trunk or sucker. The tube commences at the mouth and extends along the whole length of the body, as in the higher races of animals. The work is performed very rapidly, therefore many of them are exceedingly voracious. The body is divided into three parts, namely, head, thorax, and abdomen, which are separated into three distinct segments, but bound together by a strong articulation or joint; in the Crustacea,* however, the head and thorax frequently form but one piece. The genuine insect passes through gradual stages of development before it attains the perfect form it is destined to assume; these are, first, larva, then caterpillar, nympha or chrysalis, and, lastly, a perfect insect; nevertheless, the crustacea form an exception to this manner of change, although they are subject to a

* This great branch of the animal kingdom is composed of five distinct classes of animals; namely, *insects, myriapods, arachnidans, crustaceans, and annelidans,* all distinguishable from each other.—*Tr.*

species of renewal by molting or casting off their shells. The senses of insects are very acute, namely, those of smelling, hearing, and feeling; the latter especially is well developed, as may easily be remarked in those families of insects which, like the ants, live in communities, and seem, by their exercise, plainly to understand each other. If an insect is deprived of its antennæ or feelers, it loses all relationship with others of its kind; a plain proof that the sense of touch is the communicating bond between the individuals of the race. The eyes of insects present, in their wonderful arrangement, food for study. They are found to consist of a compound mass of hexagonal facets, which go to form the simple eye, giving to it, when seen through a magnifying glass, the appearance of the seed receptacle in the sunflower, for, as each one of these capsules is fitted with its seed, so is each one of these facets a distinct cornea. These eyes are immoveable, and covered in a remarkable manner with a dark-brown pigment, which is scarcely to be distinguished from the genuine color of the insect. Many of the races have, conjointly with this compound eye, a simple one, termed ocella, which is movable, as, for instance, those of the crustacea. The number of legs in the true and perfectly-developed insect is six, the number of wings two or four; nevertheless, in the spider and crab races, eight feet are usually found, and oftentimes more. The growth of the genuine insect is developed only by the metamorphosis it undergoes, and after passing through several stages, is perfected at once when the chrysalis fly emerges from the cocoon. The butterfly begins its life fully grown; spiders and crabs attain perfection by a regular growth.

The manner of life maintained by this class of animated

nature is very different; the greater number, having the more perfect respiratory apparatus, live on land; others, breathing through gills, like the crabs, dwell principally in the water; some live solitary and alone, troubling themselves little about one another, while, on the other hand, bees, wasps, and ants, live in communities, build artistically-arranged dwellings, which serve for a general home for themselves and young ones, labor in concert, and have a regular government. Nor is the aliment on which they feed less different than their characteristic habits; and their organs vary according to the nature of the food necessary to their mode of life. Some subsist on plants, others entirely on flesh; many feed on whatever substances they find, and all, with few exceptions, are very voracious. They provide nests for their larvæ, exhibiting the most unerring instinct in their construction, and the number of ova deposited by some particular insects is wonderful; nor are the habitations which insects construct for themselves in all climates and countries less manifold than those of the superior races, but, on the contrary, the instinct they exhibit in the order of their communities, their cunning plans for obtaining food or escaping from danger, and the industry they display in their works, is no less surprising than admirable. Found in all countries and climates, the question has been asked of what service are insects to man, as they are rather considered pests than otherwise, the little use ever made of them by no means counterbalancing the serious evils produced by their ravages, both in the fields and dwellings, proving the torment of men and animals by their irritating stingings, which, in many cases, are poisonous. Nevertheless, as nothing has been created in vain, some good, as well as evil, is

produced by their agency. Many feed upon putrid animal or vegetable matters, which might otherwise become dangerous or fatal; others are made use of in medicine and the arts; a few furnish food for man, and some give pleasure to the observer by their brilliant colors. They also serve as nourishment for many species of animals, birds, and fishes; and a few of the races, which furnish honey, wax, and silk to man, add much to his comfort and are greatly prized.

Insects are divided into three large divisions, namely:

I.—*Crustacea*, to which belong Crabs, Lobsters, Sea-lice, etc.

II.—*Arachnidæ*, or *Spinners*, as Spiders, Mites, etc.

III.—*True Insects*, such as Centipedes, Flies, Crickets, Grasshoppers, Butterflies, Ants, Bees, etc.

FIRST DIVISION.

CRUSTACEA.

The *Crustacea Class* comprises all of the race that breathe through branchiæ that lie concealed under the borders of their shells. They have no wings; the eyes, of which most of them have two, of a very complicated structure, are composed of a number of small facets covered with one cornea; the head is provided with four antennæ or feelers; the mouth is furnished with three pair of jaws, and behind these are the palpi, which are small articulated filaments, and are employed by the

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animal in recognizing its food.* They cast their shells often during life, and as often renew them. Most of the crustacea live in the water and feed upon flesh. They are divided into two families, first, those which have the body provided with regular limbs, and covered with a hard shell, as the crabs; and, secondly, those of which the exterior envelope is less solid than that of the testaceous tribes, and which, bearing more resemblance to the mollusca, are therefore termed *Molluscous Insects.*

FIRST ORDER.

BRACHYURA, OR CRABS.

The *River Crab* (astacus fluviatilis) is about four inches long, and one inch in thickness; of a brownish-green color; has a broad tail; the first pair of legs are large pincers or claws; the true legs are situated directly behind these, and arranged for locomotion. Crabs are found in all the brooks of Europe, and are sometimes kept in troughs filled daily with fresh water, but, notwithstanding this care, do not live long; however, enveloped in nettles, they bear transportation. They crawl about constantly, both by day and night, in the water; and in the cold season creep into holes on the banks. Crabs feed on snails, frogs, and dead fish; but when out of the water they will eat fruit—elder berries for instance—milk and bran; in winter and spring they are easily taken in the holes to which they have retired in the cold season; in the summer from under the stones where they

* Some naturalists recognize six pairs of jaws; the first pair are called mandibles, the two next are jaws, properly so called, and the three last are termed foot-jaws.—*Tr.*

harbor. It is usual to catch them in traps made of basket-work, baited with a frog, and sunk by means of weights. But a few minutes elapse before they assemble around the bait, and at the proper time the net is drawn up; they bite more readily when a thunder-storm is threatening. They turn red in boiling; some, however, of the cray-fish remain dark. The usual method of killing these poor creatures is by throwing them into boiling water whilst living, and cooks never consider them dead until the tail stands straight out; unlike oysters, they are best in the months which have no R in the name. This species have teeth in the stomach, and near them round calcareous substances, called crab's eyes, which are used in medicine. They cast their shells in spring time, and retreat into holes; in this state they are soft and weak, and fall an easy prey to enemies, which are often those of their own kind. If a cray-fish loses a claw or limb, it is no serious matter, as it grows out again almost as well as ever. The flesh is considered a luxury.

The *Lobster* (astacus marinus), plate 26, fig. 4, is a foot in length, and as thick as one's arm. The shell is dark brown, marbled; and with their pincers or claws, which are very strong, they are able to inflict severe wounds. They are found in all the seas of Europe, where they are taken in great numbers, and sold in all the maritime cities as a luxury. The American species is somewhat different. They deposit their eggs in July; resembling small peas, and less than those of the fresh water crabs, they are very abundant, and remain hanging from the body of the parent, each one adhering to the next by a fine filament; two thousand, thus connected, have often been counted as the produce of one lobster.

The *Locustæ* (palinurus quadricornis) are quite as large as the above described; the rarapace terminates in two long spiny points; the color is a greenish-brown; tail covered with yellow spots; the feet marbled red and yellow. They are found principally in the Mediterranean, where lobsters are scarce, but, like the latter, when taken are observed to be without claws or nippers.

The *Diogenes* or *Hermit Crab* (pagurus diogenes), also denominated the *Soldier Crab*, has, on the first, fourth, and fifth foot, a pair of nippers; the abdomen is very soft; therefore, to defend itself and provide a house, it seeks the shell of some neighboring mollusk, and having devoured the owner, establishes itself in the possession of the domicil. Sometimes, when valuable shells have been laid out on the shore to bleach, these pirates will crawl into them at night, and before the depredation is discovered, go back with their booty into the sea. Any attempt made to dislodge them meets with a steady resistance; they only retreat farther within, and are so firm in retaining possession, that oftentimes they will suffer themselves to be roasted within the shell, rather than leave it. Many, however, are driven forth by a live coal being placed on the carapace. The soldier crab inhabits the waters of the Mediterranean, but there is a larger race found in the East Indies which resembles this in habits and form.

The *Shrimps* (crangon vulgaris) are two inches in length; of a dull green color, and about as thick as a little finger. They have simple feet, which terminate with pincers; the body is very soft, and the flesh regarded as a dainty. They are found in great abundance—millions it is said—on the coasts of France, England, and Germany, and are much sought after by the fishermen.

The *Sea Crab* (portunas mænas) has a hard corselet on the breast, which is somewhat rounded, and causes it to resemble a spider rather than a crab; the length is two inches, the breadth the same; the tail is very short, and the whole of the body, of a grayish-green color, is rather square than oval. The portunas are found on all the coasts of Europe, where they live under stones. If any one approaches, they run off quickly and hide themselves in the mud; their motion is mostly sidewise. The flesh is esteemed best when the shell is molted.

The *Pocket Crab* (cancer pagurus) is about a span in length and breadth; of a yellowish color with black claws; it lives alone; is common on the sea coasts of Europe, and is the most highly esteemed of the crab race. The upper shell is removed, like that of the oyster, and the marrow-like flesh eaten in the same way.

Resembling it is

The *Spider Crab* or *Sea Spider* (major squinato), which is four inches long, and three broad, full of horny knobs, and having the head armed with a few spines.

The *Common Land Crab* (gecarsinus ruricola), about the size of a hand, is dark red, spotted with yellow, and is very abundant in South America. These crabs are essentially terrestrial, living, sometimes, a considerable distance from the sea-shore, to which they make an annual journey in order to deposit their eggs. When about to molt their shells, they make holes in the earth, which they cover at the mouth with leaves and dirt, leaving only one small opening for entrance. Here they remain, seemingly immovable, until the shell is thrown off. When these animals are in danger of being taken, they retreat to their hiding places with great rapidity, and defend themselves stoutly with their nip-

pers, which they fasten upon an enemy with so much fierceness and take so firm a hold, that very often a claw is left behind, seeming still to perform its duty, while the owner is making off. During the journey to the sea, at spawning time, they are seen crawling about in great numbers, everywhere, and often find their way by night into bedrooms, where they creep into the sleeper's shoes; therefore it is not uncommon, on putting the foot into the shoe in the morning, to get a nip from the pincers. As they are very good eating they are taken in great numbers.

The lesser races are as follows:

The *Carp Louse* (angulus foliaceus), which is flat, of of a greenish-yellow color, about or over two lines in length; they are found attached to young fishes, whose fluids they suck; these parasites fasten upon them in such numbers as to destroy life.

The *Sea Lice* (cyamus ceti) are oblong, flat, one inch long, and have seven pairs of feet; are found adhering to whales, in whose fins they make deep fissures.

The *Water Flea* or the *Miser* (gammarus pulex), is half an inch long, and the tenth of an inch or a line in breadth; the fore feet are armed with small nippers. They are found in pools, ditches, etc.; swimming around in great numbers, they feed on decaying vegetable matter, roots, and larvæ of water insects; settle largely on water-cresses, and are considered, though erroneously, to be poisonous.

The *Millepedes* or *Wood Lice* (oniscus asellus), are half an inch long; gray, but have yellow dots on the back; are found in all cellars, out-houses, under stones, etc. They can not live except in damp earth or shaded situations; feed on decaying moss or leaves, and never

roll themselves into a ball before they leap, as does the smaller species of onisci which much resembles them. These called the *Mailed* wood lice, are blue gray, and rolled up like grains of shot, move about with great ease. This genus was used, in the early times, in medicine.

SECOND ORDER.

MOLLUSCOUS INSECTS.

Among which belong,

The *One-Eye* (polyphemus oculus); these creatures are extremely small, and abound in stagnant waters, where they swim about most actively; in size not greater than a flea; have one large eye, two feelers, and a forked tail.

The *Fork Fleas* (daphnia pulex), as large as the head of a pin; congregate in such numbers as to give the waters in which they harbor a red appearance, and if some vegetable filaments are thrown among them, their lively movements can easily be distinguished, as they swim around the new object in ceaseless and innumerable circlings.

SECOND DIVISION.

ARACHNOIDES, OR SPINNERS.

FIRST ORDER.

ARACHNIDIANS, OR INSECTS OF THE SPIDER KIND.

This division includes two orders, namely, such as breathe through lungs, and others, which, like insects, are provided with trachea or spiracles, as mites.

The first order is separated into two families, namely, Spiders and Scorpions.

The *Arachnæ* or *Spider* has eight legs, and from six to eight eyes. On the posterior portion of the body are found five warts, termed *spinnerets*, by whose agency the silk, a matter secreted by a peculiar apparatus in the abdomen of the spider, escapes through a small opening, and is spun into threads of delicate texture but considerable strength. These threads, at the moment of escaping from the spinnerets, are glutinous and require to be dried before employed, but in weather when the temperature is favorable, a single instant is sufficient for this purpose; nevertheless, while it is yet moist the spider fastens the ends of the threads to such objects as are intended to support the structure of his web. Attempts have been made to manufacture gloves and stockings from spiders' silk, but without success, as the quantity furnished by each is so small that it would require entirely too many spiders to obtain it in sufficient quantity to be useful. Most spiders, as is well known, construct their webs very skillfully, with a peculiar hiding-place in the center or bottom, in which citadel it places itself. The slightest movement of one of the threads which go out from the net gives notice that a victim is caught, and in an instant the wily watcher sallies forth and seizes the prey. Many spiders have their mandibles furnished with a kind of venomous dart, with which he pierces the victim; one stroke is mostly sufficient; this accomplished, the spider sucks the juices, and rejects all the other portions of the body. The female spiders also employ their silk in constructing bags to contain their eggs, until the young are able to come forth. They are a fierce and voracious race, and when confined attack and

prey upon their own kind without mercy. The most remarkable of this class is

The *Great American* or *Bird Spider* (mygale avicularia), plate 26, fig. 2, which is the largest known of all the spider race. The body is about two inches in length, black, and covered with strong hairs, as are also the feet, which are well proportioned strong and large; the anterior extremities are provided with hooked claws. They construct a net at least two feet wide and about as thick as fine muslin; at one end is a bag almost as large as a pigeon's egg, in which the spider deposits its eggs to the number of one hundred. They are found in South America, mostly in the primeval forests, but at times are found in the houses, going forth at night in search of food, which, for the most part, consists of insects, although they kill small birds also, and are particularly dangerous to the young brood of Colibri. If unwarily seized, they will bite, and the mandibles, being provided with venom, distill into the wound a poison that acts promptly and produces inflammation, which is sometimes dangerous. There is a relative species which live in holes in the earth.

The *Common Spider* (aranea domestica). Scarcely half an inch in size, of a brownish-gray, oval-shaped and hairy, it makes a thick web, as is well known, in every corner; situated at one end of the net is a tube, into which they drag the flies when they have captured them. They are very industrious spinners, and although their work may be destroyed many times, they renew their webs in a very short space. The spinning material is, however, at last exhausted, and then, when in want of food, they live by piracy, and rob others. The skins are cast annually, and they divest themselves so adroitly of

the old covering, that it is easy to mistake the cast-off integument for a genuine spider. The handsomest of the spider race is

The *Cross Spider* (epeira diadema), and well known. The posterior portion of the body is large, round, and either dark brown or reddish; when of the first-mentioned color, it is ornamented with white lines, and of the second, with yellow in the shape of a cross. They are skillful spinners, and arrange their webs perpendicularly between two garden posts, or in the forks of a tree. The manner in which they spin is remarkable. Choosing a firm position, they draw one thread of two or three yards long, leaving the end loose and flying until it fastens itself somewhere; this serves as a kind of bridge, and the spider running backward and forward upon it, most assiduously doubles and strengthens it for a foundation. The bridge or scaffolding thus completed, the spider makes a number of parallel threads, then, with the same artistic precision, arranges others across, using the same clammy substance to bind them to each other and perfect the structure, a work which in clear weather is accomplished very rapidly. At length the little creature retires to a retreat formed in the bottom or middle of the web, where, with its head directed downwards, it lies in wait for unwary insects, which, when of the smaller kind, are soon seized, dragged in this cell, and devoured. Some of the larger flies make strong resistance; in such a case the spider hastens to bind the victim fast by spinning strong threads round its body, so that it can neither move its wings nor feet; the prey thus secured, the tyrant proceeds to devour it at once, or retains it in its silken bonds to feed upon it at leisure. The female cross spider is larger than the male, producing in autumn a thousand

yellowish eggs, which they inclose in bags or cocoons, spun over with silk; this important task accomplished, the mother spider dies. The young come forth in May, and soon afterwards begin to spin. As they begin life by hundreds, and can, consequently, do much damage in gardens, it is necessary to destroy them, which is easily done with spirits of turpentine. This family is not poisonous.

The *Water Spider* (argyroneta aquatica) is longish, dark brown, with hairy feet, and lives the whole year round in stagnant waters and ditches; it does not, as is generally supposed, run on the top of the water, but swims. Water spiders have large pincers in front; they swim on their backs, turning the under surface of their bodies upwards. As they dart along on the top of the water, they look like little balls of quicksilver. This brilliant appearance is bestowed by the air-bladders found on the posterior part of the body and feet. When they want a new inspiration, they turn the posterior portion of the body outwards. Their appearance under the water is very remarkable; they are enclosed in a bubble of air which surrounds them like a box. This bubble, looking like a diving-bell made of thick, white silk, is about as large as a pigeon's egg, adheres to their hairs, and enclosed within it, they perform their several functions of eating, spinning, etc., without any disturbance to their operations.

The *Tarantula* (lycosa tarantula) is one inch long, spotted black above, red below, and is found in southern Italy and North Africa. Their bite is considered dangerous, particularly in hot weather. It was a popular belief in the early times, and still exists in lower Italy, that the bite of the tarantula occasioned a kind of St.

Vitus's dance, in which the person bitten was obliged to laugh and skip about until he sunk down exhausted. This dreadful disorder is said to be cured only by music; for this purpose a particular tune, called the Tarantelle, is played in presence of the sufferer, and believed to be an infallible remedy.

The *Mowers* or *Weavers* (phalangium opilio) have small, roundish bodies, with remarkably long legs; not larger than peas, they are brown-gray above, whitish below; in the summer months they are found in considerable numbers, living on trees and walls. They are very active and, when running, appear as if mounted on stilts; their legs break off readily on being touched, and move convulsively for some time after being separated from the trunk. They feed upon flies and mites. A relative species, but bearing more resemblance to the tarantula, is found in southern Russia, and considered poisonous.

The *Common Scorpion* (scorpio europæus) is one inch long without including the tail, has pincers in front like the crab; the tail is composed of six rings or joints, terminating in an excessively acute point or sting, arcuated outwards. Scorpions are vivaparous; they are very abundant in Italy, concealing themselves under stones and other bodies, mostly, however, in ruins, and sometimes in houses. Keeping closely in their retreats during the day, they sally forth at night, run actively everywhere, moving their pincers and elevating their tails. The sting of the scorpion produces severe inflammation, but in Europe is seldom fatal. These irascible creature will not bear imprisonment; if a scorpion is confined in a glass jar or hemmed in by fire, as soon as it finds escape impossible, it stings itself to death. The

males have fearful battles with each other, mostly from jealousy, which end fatally. The Indian Scorpion, which is found in Guinea and Ceylon, but principally in India, resembles the European, is very venomous and the sting more likely to produce serious consequences. The remedy usually employed is olive oil, in which a scorpion has been suffered to die; or even the flesh of the creature itself, applied to the wound, is considered a specific.

The *Dracunculus* (thelephonus caudatus), plate 26, fig. 6, is as large as the European scorpion, has short nippers, and looks much like a field cricket, and, from having a long, thread-like tail, is called the thread scorpion. Its color is a handsome dark red, and between the rings milk-white. It is a native of the East Indies. Its habits are unknown.

ORDER II.

ARACHNIDA TRACHEARIA.

To this order of spiders, which breathe through trachea, belongs, first,

The *Paper Moth, Book Scorpion*(obisium cancroides), which resembles a bug, is flat, has long pincers in front, found in Europe and America during the whole year, harbors among paper, in old books, and under the barks of trees, etc., feeds on small insects, mites, book worms, and wood lice, and is therefore a useful creature, and deserves the protection of man. It has no sting, and never resists an enemy.

The *Dog Tick* (ixodes caninus) is as large as a grain of hempseed, of a dark violet color, with brown head and feet, lives on different species of plants found in the

woods, namely, the various mosses. These pests attach themselves to hunting dogs, upon which they drop from the trees, and fasten so closely by means of their proboscis which is barbed, that it is difficult to remove them when they are once fairly inserted in the skin. When filled to repletion they are as large as a small hazelnut; these parasitic arachnidans are not only a torment to dogs, but they also attach themselves to oxen and other four-footed beasts, and not even sparing man. A few drops of sweet oil, it is said, kills them, and they fall off immediately; nevertheless, spirits of turpentine is perhaps more reliable in its effects. If detached too hastily the sting remains in the skin and excites inflammation. Resembling this species is

The *Sheep Tick*, which differs only in color, which is gray, with black on the feet and back.

The *American Tick* (acarus americanus) is also as large as a grain of hempseed, but when it has sucked its fill, it is enlarged to the size of the end of a finger; its shape is oval; its color red with white dots on the back. They are very numerous, and constitute a true pest. Their sting is so fine that its entrance into the flesh is not remarked until it has been insinuated to some depth, when it is necessary to extract it carefully with a pair of forceps arranged for the purpose. When they have satisfied their voracity to the full, they drop off, but not without having first made a nest of the wound under the skin, in which they deposit an immense number of eggs; these suffered to remain, great irritation ensues, occasioning hectic fever. The pain is said to be intolerable, and a disease is created which destroys life, both in man and beast.

A relative species is found in Persia, the sting of

which is fatal to Europeans, but never injurious to the natives.

The *Cheese Mite* (acarus casei) is very small, soft, and has feet which terminate in points, resembling small bladders. Seen through a magnifying-glass, they appear like oval bodies, white, spotted with brown, and provided with long hairs, which are movable. They abound in old cheese, mouldy bread, etc.

The *Meal Tick* (acarus farinæ) resembles the foregoing, but is smaller; is white, head and feet reddish. These creatures live by millions in old meal; when dried fruits are kept long, they become covered with a white substance resembling sugar, which is, however, nothing more than a collection of mites, that thus envelope and destroy the article. Similar plagues find their way into feathers, old books, etc., in short, into everything capable of being destroyed.

The *Aquatic Mite* (hydrochna aquatica), the handsomest of the species; is small, scarlet-colored, and may be seen swimming lustily around in all stagnant waters.

THIRD DIVISION.

TRUE INSECTS.—HEXAPODS (SIX-FOOTED).

The genuine Insect race differs from the Arachnidæ and Crustaceá in the arrangement of their respiratory organs (breathing, without exception, through trachea), as well as in the possession of wings, and the presence of six feet. Some, indeed, are without wings, and might, perhaps, with propriety be classed in the orders

already described. All insects undergo certain metamorphoses, but the changes are not always of the same nature; some experience only a partial metamorphosis; some a demi-metamorphosis, and others a complete change. They are divided into winged and unwinged. The first undergo a perfect transformation, such as the butterfly, which passes through several stages; first, the larvæ; then the nympha; and, lastly, attains the state of a perfected creature in the form of a butterfly. Some, termed suctorial insects, do not undergo any metamorphosis, and are unwinged; others, which are apterous or unwinged, such as the locust and grasshopper, are subject to a partial transformation. All, with the exception of the millipedes, have six feet, as soon as the full perfection is attained. They are divided into five orders.*

FIRST ORDER: .. APTERA.—Insects without any wings; *millipedes, spiders*, etc.
SECOND ORDER: COLEOPTERA.—*Beetles*, etc.
THIRD ORDER: . ORTHOPTERA.—*Crickets, Locusts*, etc.
FOURTH ORDER: LEPIDOPTERA.—*Butterflies.*
FIFTH ORDER:.. HYMEROPTERA.—*Bees, Gnats*, etc.

FIRST ORDER.

APTERA.—UNWINGED INSECTS.

The *Millipede* (julus terrestris) belongs to this order, and has a long cylindrical body, like an earth-worm,

* Modern naturalists have divided insects into eleven orders. Linnæus forms them into seven, founding the division upon the absence or presence of wings; their number, texture, arrangement, and nature of their surface; and upon the existence or absence of a sting. Many follow Linnæus, because his classification, being more simple, affords to the general reader, upon the whole, a clearer view of the

covered with a hard skin divided into segments, resembling that of a cellar worm; its length is one inch and a half; color, blue-gray with yellow spots; it has, it is said, eighty feet, and on the posterior segment, a sting; it rolls itself into a spiral form. Most of this genus live under stones, where they find nourishment among decayed wood, etc. In crawling, they touch the earth frequently with their feelers; the young at first have only six legs, but as they experience an imperfect metamorphosis, the number increases. If rubbed between the fingers they emit an unpleasant odor. They deposit their eggs in the earth; a relative kind, nine inches long and as thick as a finger, is found in South America.

The *Centipedes* (scolopendra morsitans), plate 26, fig. 7, have a flat, ribbon-like body, divided into hard segments; their mouths are furnished with small, sharp teeth, which are hollow and filled with venom. They are six inches long, and nearly half an inch in breadth; have twenty-one pairs of feet, and eight eyes. The color is yellow, with black on the edges. They are found in the torrid zone, living among rotten wood, in books, straw, etc. The bite is very painful, but not deadly. They have been carried, living, to Holland, by ships in which they harbored. Insects wounded by them die instantly. They will crawl over the faces of persons sleeping, and on any attempt to take them, bite severely.

The *Sugar Worm* (lepisma saccharina) is three quarters of an inch in length, covered with silvery scales; has six feet; long hairy feelers, and three sim-

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subject than could be presented in the same compass by following the later and more strictly anatomical methods of other naturalists. The author of the present work has simplified still more, by dividing insects into five orders only.—*Tr.*

ilar filaments at the caudal extremity. It harbors in damp places, and delights in articles made of sugar; runs rapidly, shooting forward like a fish. Although found in Europe, it is not a native, but has been carried there from America.

The *Louse* (pediculus capitis). This well known pest is about a line in length, only half as broad; the skin is hard and parchment-like, and when roughly pressed cracks with a noise. It has six feet; in front is a proboscis or sucker, with which it pierces the skin. It infests the head of human beings and other warm-blooded animals, and multiplies most rapidly. Within the space of six days a louse will lay fifty eggs, which are called *nits;* in six more the young come forth, so that in eight weeks one louse grandmother can number five thousand descendants. If a louse, placed upon a human head, is examined through a magnifying glass, it will be seen first to search for a pore into which it insinuates its proboscis, and the body being transparent, a stream of blood is at once perceived to rush into the stomach. Lice belong to temperate climates only; it is said that they are certain to vanish from any one, however lousy he may be, as soon as the equator is passed. Those found on the negroes—a case which never occurs south of the line—are black, and smaller than those which infest the white races. There are several other species found in clothing, etc.; some are very small, others as large as an apple seed; these abound in Mexico. A strong decoction of parsley seed, it is said, secures an effectual riddance of these disgusting vermin.

The *Flea* (pulex irritans) is reddish-brown, and about half a line in length; the body is encased in a kind of finely-wrought armor. It has a sharp trunk which it

buries in the skin, and the legs are adapted for leaping. Fleas are not only the pests of man, but harbor in the hair of dogs, cats, etc.; it is said that they do not trouble horses, because the odor of that animal is offensive to them. They never live in localities, like the louse, but spring about everywhere. They deposit their eggs in rotten wood or damp dust, the larvæ soon appear, and shortly afterwards the flea is developed. The female is larger than the male; the trunk is provided with two valves, or rather feelers, on each side, between which it can move back or forwards. It is seldom met with in the torrid zone. These little creatures possess remarkable strength, and oftentimes overleap a space one hundred times greater than the length of their bodies. They have been instructed to perform many wonderful feats, which, exhibited by itinerant showmen and known to most, need no particular description; however, it is curious enough to see them draw miniature wagons and cannon, which greatly exceed their own bodies in size and weight.

The *Sand Flea* (pulex penetrans), called in America *Chigre*, is very common in South America, where it lives in the sand; is only one-third as large as the common flea, but resembles it closely in bodily structure, except that the legs are not so long. The female chigre insinuates herself beneath the skin, particularly about the feet and toes, where she deposits her eggs. These are carried in a kind of sack under the posterior portion of the body, and thus inserted beneath the nails or in other portions of the skin, cause great pain and ill-conditioned sores. The only remedy is to extract the flea and sack at once, taking care not to break the latter. This is easily done by attending to the first intimation

of the presence of the flea, but if neglected, serious consequences ensue, making amputation necessary. The term sand flea is hardly proper, as the little vermin are found more frequently in clayey ground than sand, and are most abundant in spots recently cleared from primeval growth, and where previously they were altogether unknown.

SECOND ORDER.

COLEOPTERA.—BEETLES.

This order comprises insects having four wings, of which the first pair are horn-like, seeming intended more as a covering to the second pair, which are membraneous, than for flight. The number included in this order is more numerous than that of any other, and they are the most remarkable among the subjects of the Third Branch of the Animal Kingdom, not only for the superior beauty of their bodily structure and brilliant coloring, but the peculiarity of their habits. In many of the classes, the palpi or suckers are so strong that they are able to divide hard substances very readily. The anterior portion of the body is enveloped in a solid cuirass, that is very frequently found armed with prickles. When the insect is in a state of repose, the membraneous or inner wings are folded up under the outer shield; but when about to fly, the wing-covers are opened, and they are spread forth.

From the eggs of these beetles, which deposit them in decaying animal or vegetable matter, proceed larvæ. These are worm-like in the first stage of their existence, and termed maggots. The head is scaly, and, being car-

nivorous, they are at once provided with instruments for mastication, and commonly have six feet. They are very voracious, and grow rapidly. Sometimes, however, they remain several years in the larvæ state before their metamorphosis is perfected. These larvæ, or soft worms, are found in all the places were the eggs were laid, living on mold, manure, and all decaying substances. When fully grown they pass into the pupa or chrysalis state, in which, seeming totally without life, they require no food, A few, however, spin themselves cocoons for a resting-place during the transition state, remaining simply in their usual home. Most of the nymphæ are of a yellowish white color; some are inclosed in a coriaceous cell like the aurelia of the butterfly, in the shape of which the form of the perfected insect is plainly visible.

The immense number of the Coleoptera or Cockchafer kind, reckoned at twenty-four thousand families, of which the tenth part belongs to Europe, are divided into three parts, namely, Herbivorous, or plant-eaters, Carnivorous, or flesh-eaters, and Anobia, or those that feed on farinaceous substances, such as the dust of decayed wood, etc.

I.—Herbivorous Insects.

The bodies of insects belonging to this family are cylindrical; the feelers like stiff hairs; the legs are composed of a number of joints. Three families belong to this division. Trunk Beetles, or Scarabeæ, Leaf-eaters, and Wood Beetles.

1.—Scarabeæ, or Beetles,

With a probosci, have elongated heads, ending with a trunk-like muzzle, on the end of which, gradually grow-

ing thicker towards the outward termination, are eleven feelers, composed of joints. The feet are strong, provided with four jointed toes. Both the perfected insect and larvæ live in different portions of plants, which, partly fresh and partly withered, are yet not really decayed. They make a cocoon of resin or silk, into which they retire to accomplish their metamorphosis. They do great injury in gardens, forests, and fields.

The *Beech Beetle* or *Springer* (orchestes fagi), plate 24, fig. 1, is one-tenth of an inch in length; black, with feelers of reddish-brown; segments of the legs the same; wing-coverings, or elytra, arranged in rows and dotted. Their legs are constituted for leaping, and they live on the beech trees, where they devour the leaves and fruit.

The *Orchard Beetle* (anthonomus pomorum), is rather more than a line in length; the body enveloped in a coat of grayish down; general color brown; covering of the back white; and feeds on the blossoms of the fruit trees. The larvæ, which are peculiarly abundant in wet seasons, live in the buds, mostly choosing those of the weaker trees, to which they do great injury. Their metamorphosis takes place at the end of May, after the larvæ have destroyed the germs of fruit.

The *Pine Beetle* (rhynchænus pini) is above half an inch in length, with a very long, thick trunk, and short feelers; of a brown color, dotted and striped with black. It is very injurious to pine forests, particularly to young or sickly trees, as it pierces the bark and buds with its trunk. The larvæ make great havoc, as they penetrate to the alburnum or sapwood. The best way of exterminating these vermin is to cut down the declining trees, clear off all fallen timber from the ground, and spare the certhia, or creepers, which are their natural enemies.

The *Nut Borer* (balaninus nucum), from two to three lines in length, is black, but covered thickly with brown hair; head, feelers, corselet, and feet are lighter. The trunk, long and fine, serves to pierce an opening into the unripe acorns and hazelnuts, where the eggs from which the larvæ develop are deposited.

The *Weevils* (calandria granaria) are the tenth of an inch in length; dark red or brown, with striped wings, and a very long, dotted, gray breast-plate. They deposit their eggs in grain stored up in granaries, mostly in the spring time. The larvæ eat the whole inside, leaving nothing but the husk. Their metamorphosis is accomplished in four or five weeks. The perfect insect is then developed, and also feeds upon the grain. The increase of these destructive insects is immense, as one weevil will deposit one hundred and fifty eggs. They generally keep a few inches below the surface of the heaped up grain; in the fall they creep further down within it, and in the spring once more come forth. The best means of getting rid of these destructive vermin is by winnowing the grain, or suffering free admission of cold air to the granary. The grain they have fed upon becomes very light, and having lost its farinaceous portion, swims on the top of water.

The *Diamond Beetle* (entimus imperialis), plate 22, fig. 10, is nearly one inch in length; has deep furrows on the wing-covers; black, with stripes and spots of brilliant green and gold color, which sparkle in all glittering splendor. It is a native of Brazil, where the ladies wear it in their hair.

The *Red Weevil* (apion frumentarius), or Cornworm, plate 22, fig. 11, is one line and a half in length; of a blood-red color, with black eyes; ridged elytra, and thin

pointed proboscis. Manner of life of this species is the same as that of the Calandræ, but they are neither so numerous nor injurious.

2.—Insects that Feed on Leaves, or Leaf-Eaters.

The head is blunt; the body oval; the feelers straight and bristle-like; legs composed of four or five joints, and, in many, are adapted for leaping. They live on the buds and leaves of plants.

The *Ground Fleas* (haltica oleracea) are a line and a half long, of a brilliant blue-green, with black feelers. They are very hurtful to many garden-plants, especially those of the cress kind. The method of protecting the plants from their ravages is by placing limed twigs across the beds, and shaking the plants, the insects spring upon them, and are caught. There are several relative species.

The *Poplar Bug* (chrysomela populi). Four lines long, head and corselet dark blue, elytra red, with black borders; found on the leaves of the black and silver poplar, willow, etc., on the leaves of which they feed voraciously.

3.—Wood Beetles,

Have rather long, cylindrical bodies, which differ much in size. Both insect and larvæ live in dry and growing wood, which they injure greatly by eating galleries through it.

The *Pine Scarabeus* (bostrichus thypographus), plate 22, fig. 6. More than two lines in length, of various shades of color, from light brown to black; the corselet

is knobbed or rugged. The female is larger than the male, and has the fore part of the head covered with hairs. This beetle is found only in the pine woods, where it commits great ravages, not only on the living tree, but also on the felled timber. The increase is very rapid and numerous, being two broods in one year. The eggs, white and shining, are about the size of a grain of millet, and are arranged in galleries under the bark. Each larva eats a new passage for itself in the alburnum or sapwood, at the end of which gallery it undergoes its transformation. These passages never cross each other, but are of singular and irregular forms, somewhat resembling the characters of Arabic writing. These scarabeæ generally seek, at first, sickly and unsound trees, but soon leave them for the healthy, and being so numerous, are hard to be dislodged from their harboring places. They puncture the bark and alburnum so severely, that the sap can not rise, and thus, deprived of nourishment, the tree dies, but, nevertheless, if felled in time, the wood can be used. There are several relative species found on other trees.

The *Fir Moth* (hylesinus piniperda), plate 22, fig. 2, is two lines in length with a rather long body, sloping towards the posterior portion; yellowish-brown or black, or else black, with reddish-brown elytra. This species infest the wood of the fir, whether in the living tree or felled timber, eating their way into it in the same manner as above described, and are quite as hurtful.

The *Common Borer* (ptinus fur) is rather more than the tenth of an inch in length, with a small head, protruding eyes, and long feelers. The body is hairy, color reddish-brown, with two small bands; on the corselet are two knobs. This beetle is the pest of museums and

collections of plants, which it entirely destroys. Nothing but strong poison will arrest it in its ravaging course; it is often brought into a cabinet or museum in cork wood, therefore it is necessary that this wood should be boiled previous to being admitted into the cabinet.

The *Domestic Beetle* or *Deathwatch* (anobium pertinax), plate 22, fig. 5, is two lines long; pale dark brown, with long feelers, and short hairs under the abdomen, dwells in old wood, and as it gnaws its way through it, makes a noise like the ticking of a watch, from it has received its name; and the superstitious, hearing this sound, regard it as a herald of death. On being caught, this insect feigns itself to be dead, and is so obstinate, that it will suffer itself to be roasted alive, rather than show signs of life.

The *Smith* or *Jumping Beetle* (elater pectinicornis), is known by the term of *Skipjack*, and over half an inch in length; brilliant green with black feelers. The head is small and retreating; the feet so short, that if the creature falls on its back, it can not turn by the ordinary effort, but springs perpendicularly into the air, so as to recover the natural position; this is effected by applying the feet to the outside of the body, which has particular impressions for their reception, depressing the head and thorax and the point of the post-sternum against the sides of the medio-sternum* with a jerk, the body is by its elasticity elevated into the air. It lives in moldering wood, and is altogether harmless. There are many

* The thorax is the middle portion of the body. The middle line of the inferior surface of the trunk is termed the *sternum*, and is divided into three parts: the *ante-sternum*, *medio-sternum*, and *post-sternum*.—Ruschenburger.

relative species, one of which, found in the West Indies, diffuses a brilliant light.

The *Richard** (buprestis chrysostigma), plate 22, fig. 7, is classed among the handsomest beetles. The body is very cylindrical, the head round and received within the thorax, the antennæ short; the length is about five lines, reddish-brown above, golden-green below, under surface and wings red, the latter bordered with purple, the posterior portion of the body violet. They are found in oak forests. When menaced with danger, they contract their antennæ and legs, and drop upon the ground, with a view, no doubt, to conceal themselves in the adjacent herbage. The smaller buprestides are found on willows, hazel bushes, etc. The largest, which are natives of South America, are extremely beautiful, and present a brilliant surface, glittering, as it were, with an iridescent luster, resembling that of jewels.

The *Common Carpenter Worm* (lamia ædilis) is half an inch long, with antennæ five times the length of the body. The color is brownish-gray, with paler bands, and four spots of foul yellow on the corselet. It is without wings, and lays its eggs in pine wood prepared for the carpenter, in which the larva forms such deep burrows as frequently to render it altogether useless.

The *Longarmed Carpenter Beetle*† (lamia longimana), one of the largest of the lamiariæ, is three inches long, clear olive color, marked with lines of black, light brown, and flame color. The segments of the antennæ are very

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* So called on account of the extreme richness of their external covering. It is stated that there are not less than five hundred species of the genus Buprestis in the Berlin Museum.—*Tr.*

† By some called the *Carpenter's Jack.*

long, and the fore legs twice as long as the whole body. It is found in South America.

The *Musk Beetle* (cerambyx moschatus), plate 22, fig. 9, is of a shining green, exceeds an inch in length, and its presence is often betrayed by its peculiar scent, which somewhat resembles that of a mixture of musk and roses. The antennæ are divided into segments, and of such extreme length as to form a distinguishing peculiarity of the genera. This species mostly live in the decayed trunks of willows.

The *Oak Beetle* (cerambyx heros) is nearly two inches in length, entirely black, except at the posterior portion of the body, where it is dashed with reddish-brown. The larvæ, measuring four inches, live in oak wood, where they commit great ravages.

The *Common Sawyer* (prionus serrarius) is more than a half inch long; black, with elytra or wing-covers of reddish-brown; the antennæ are very long; the body broad; the legs are also brown, and serrated. In the larvæ state it lives in the rotten trunks of oaks and pines.

II.—Carnivorous Beetles.

Beetles which live on flesh have the body long and flat, the feelers short, maxillæ large and pointed; the legs are mostly composed of five joints without barbs, and live on the flesh of living or dead animals. They are divided into three families: *Voracious Beetles*, *Parasites*, and *Carrion Beetles*.

1.—Voracious Beetles.

Their bodies are long and flat; the wing covers crustaceous; the head is broad, with protruding jaws and thread-like antennæ; the legs or tarsi are mostly five-jointed.

The *Red-footed Beetle* (tachinus rufipes)* is about a line in length, black; the posterior portion of the body hairy; feet and anterior of a brown-red. Found in decayed mushrooms.

The *Club Bearer* (claviger testaceus) is a small insect, three fourths of a line in length; light brown. These little creatures are always found in anthills, where they live in great amity with the busy little emmets, which cherish these minute creatures tenderly. The reason of this friendship, it is said, is, that a certain juice exudes from their small and hirsute bodies on which the ants feed.

The *Black* or *Rove Beetle* (staphylinus olens), plate 22, fig. 4, is one inch long, three tenths of an inch broad; black, with brown wings, and is found everywhere; in manured fields, wherever there is ordure, or upon decaying animal substances; it is very bold, and seizes upon everything that comes in its way.

The *Bombardier* (brachinus crepitans), one inch long, three lines broad; the posterior portion of the body rather square than round; of a fulvous orange; the third and fourth joints are black; the elytra blue-black or green. It is found under stones, and receives its name from its explosive powers, for, if held between the fingers, it ejects a caustic fluid secreted by organs within

* Or *Mushroom Beetle.*

the abdomen. This is their only means of defense, and, escaping with a noise, the creature makes use of it to alarm and drive off its enemies.

The *Hessian Fly Root Beetle* (zabrus gibbus) is one inch long; flat and brown; the larvæ are very injurious to fields; they begin the work of devastation in autumn, and eat the roots of winter grain. The following summer the beetles feast on what the grubs have left, sagaciously keeping under clods in the daytime, but at night climbing on the stalk, they devour all before them, and thus ruin the harvest.

The *Golden* or *Dor Beetle* (carabus auratus) is oblong, with arched or convex wings; as these are elytra only, and not genuine wings, it does not fly; the mandibles are strong; its length is one inch, breadth three lines; its color is brilliant green, something resembling polished copper, hence its name. It is found under stones, and in the neighborhood of dunghills, and is the most inveterate foe of the maybugs, pursuing and devouring them without mercy.

The *Ground Beetle* (carabus coriaceus) is one of the largest found in Europe; its length is more than an inch, its color dull black.

The *Little Caterpillar Hunter* (carabus inquisitor) is eight lines long, winged; its color is a beautiful coppery green, resembling *verd antique*. The posterior portion of the body is angular. It is rather rare, and feeds on caterpillars, going out to hunt them in the morning and evening.

The *Larger Hunting Beetle* (carabus sycophanta), plate 17, fig. 6, measures more than an inch; its color is a dark violet, but on the abdomen and wing-cases golden-green or brilliant copper; it goes after all cater-

pillars, but seeks principally those of the processionea, which are found on the oak trees.

The *Tiger* or *Sand Beetle* (cincindela campestris). The abdomen is oval and flat, the elytra flat, the head thick; it is six lines long, and two and a half broad; blue above, golden-green below, and each wing-case ornamented with six white spots. These beautiful insects are met with everywhere on sandy banks, either flying or moving about with great activity, and, sparkling in the sunbeams, appear like flying gems. Very ferocious, and a deadly enemy to other insects, they receive their name from the inveterate pursuit they maintain against them. Their soft white larvæ bury themselves in the sand, keeping only their heads above it, and maintain a steady watch for the approach of prey. There are other varieties, some of which are red, others black.

The *Water Flea* (gyrinus natator), sometimes called *Whirlwigs*, are barely two and a half lines long; of a brilliant black, with yellow feet, they are frequently seen in spring time on the surface of quiet waters, over which they swim or glide with extreme agility.

The *Water Beetle* (dytiscus latissimus), plate 22, fig. 15, is nearly an inch and a half long, and about one inch broad; dark brown above, head, neck, and elytra bordered with black; the posterior pair of feet are furnished with strong hairs, which aid them in swimming, and in the males the first pair of anterior tarsi are covered with small bodies, like suckers, by which they hold fast. They are very voracious, and feed on all the small animals that are usually found in water, whether living or dead. If taken out of the pond, which is not easily done, being hard to catch, they discharge a drop of white fluid, which emits a very disagreeable odor. They

fly by night from one pool to another, and feed ravenously on putrid substances.

The *Great Swimmer* (hydrophilus piceus) is more than an inch and a half in length, of shining black; the forelegs, mandibles, and feelers, which are knobbed, are brown. These beetles swim and dive with great dexterity, fly well, but run badly. The female has, under the abdomen, two spinnerets, with which she fashions a cell or case for her eggs; with this provision her care is ended, for, safely hidden within their silken boat, they float lightly over the smooth or stagnant waters which they inhabit until the time that nature calls them forth.

2.—Parasite Beetles.

The *Malacodermi* or *Soft-winged* beetles have mostly cylindrical bodies, with long, slender, and soft elytra; the head is round, and nearly hidden within the thorax; the antennæ are short and simple. In the larvæ state they live in common with the greater part of mites—as parasites, on other insects—as beetles feed on leaves and buds, which serve them for food.

The *Glow Worm* (lampyris noctiluca) is long and flat; the female has no wings, and is therefore called *Glow* or *Light Worm*. These beetles fly about the fields and orchards at night, giving forth a phosphorescent luster; the female lies in the grass, and illumines the space around her. The male, scarcely four lines long, and brownish, is seldom seen flying, and his light, that he does not liberally dispense, is not clear. The female is half an inch long, flat, and consisting of a number of rings, resembles the common cellar worms; has six feet, but neither wings nor elytra, and is sometimes called

St. John's Worm. The light issues from the abdomen, and the animal can vary its intensity at pleasure. By day these insects bury themselves in the grass, but, creeping forth at night, they emit a shining light which distinguishes them from all others of the beetle race.

The *Lesser Glow Worm* (lampyris splendidula) is about four lines in length; dark brown, with two pale but transparent spots on the thorax; the legs are yellow. The female has short wings, is whitish rather than brown, and in length about five lines. The luminous matter occupies the under side of the two or three terminal segments of the abdomen, and is more brilliant than that of the lampyrus noctiluca. The light of the male is also stronger, and as these insects are seen flying about in the warm summer nights by hundreds, they present a natural and beautiful illumination comparable to numberless little moving stars. In Northern Europe this species of lampyris is more common than the fire-fly, which inhabits only warm climates. There is a race of lampirii found in Italy, where the males are winged as well as the females.

The *Raspberry Bug* (dasytes niger). Two lines in length; black, and covered with hair. The larvæ are often met with in raspberries.

The *Bee Wolf* (trichodes apiarius), half an inch long, is hirsute, black, and blue; the elytra adorned with three red bands. These beetles live on flowers, but lay their eggs in the nests of bees. The larvæ feed upon those of the bees, and thus do much damage in the hives.

The *Lady Bug* (pyrochroa coccinea), is from five to six lines in length; black, with the antennæ terminated by a compressed mass, composed of the terminal joints, forming a reversed conical club; the elytra and thorax

of a brilliant scarlet color. Is found in the flowers of blooming hedges.

The *Cantharides* or *Spanish Flies* (lytta vesicatoria), plate 22, fig. 13, are ten lines long; altogether of a brilliant golden-green color, with black antennæ. Inhabit the south of Europe, where they are found so abundantly on the bushes of the elder, lilac, and ash, that they are gathered by the bushel. In more northern climates (Germany) they appear about the time of the summer solstice. Their presence is betrayed by a most peculiar and penetrating odor, emitted from their bodies, and they consume the leaves of the young trees so closely as to leave them altogether bare, thus causing great ravages. These little insects contain a peculiar irritating matter, which, when applied to the skin, has the property of producing a blister, and are therefore considered valuable on account of their great utility in medicine.

The *May Bug* (meloe proscarabeus), plate 22, fig. 8, has a thick, cylindrical body; more than an inch long; of a dark violet color, with a golden luster. Is found, mostly in the mornings, on banks or ridges where violets and the plant called the lion's-tooth grow, on the leaves of which it feeds. The larvæ subsist on flies. These insects also possess the vesicating property, although in less degree than the Spanish fly, and are used for the same purpose.

3.—Carrion Beetles.

These beetles are nearly round, and mostly have on their bodies small channels, into which they can contract their limbs. Most of this tribe live on carcasses, or other putrid matter.

The *Cabinet Beetle* (anthrenus museorum), plate 22, fig. 1, is about one tenth of an inch long, of a dark color, but altogether covered with scales of a whitish-gray, which changes in the elytra to bands of reddish brown. These scales, like the hairs on the wings of butterflies, are easily abraded. They are found in museums or collections of insects, where they are very injurious. Their larvæ are brown, and can eat their way through horn or wood.

The *Bacon Beetle* (dermestes lardarius) is small and oval; about four lines long; of a pale black, with transverse bands of gray on the wing-covers. These insects feed upon the skin and flesh of animals, and are found in bacon or other smoked meats, and even make their way in cabinets of stuffed birds or animals, where they commit great ravages. If touched they feign themselves dead. A smaller species is the Fur Moth, which is considered a terrible scourge to the furrier and collector of dried insects. Nothing but extreme cleanliness can arrest their depredations. Oil of turpentine, mercury, and all other detergents of the same kind, have hitherto proved ineffectual to extirpate the injurious insects.

The *Lady Bird* or *Lady Cow* (coccinella septempunctata), is a very small, pretty beetle, about three lines long, with the elytra red, but having seven black dots, three on each wing and one in the middle. These pretty insects are very useful, as both in the perfect insect and larvæ state they feed upon plant lice, or Aphidæ, and destroy them in great numbers.

The *Black Leaf Lion* (coccinella morio) resembles the lady bird, except that the body is black, spotted with red. Its larvæ, which wages a murderous warfare with the aphides, is the white caterpillar so often seen, and is

clothed with silky white bristles, that, like the prickles of the hedge hog, stand up erect. These, formed by a peculiar secretion, which exudes from the body, are easily removed, for if the creature is only touched, they adhere to the finger, but if the larvæ is entirely bared, it sustains no injury, as they are rapidly replaced.

The *Turnip Fly* (nitidula ænea) is a line in length, of a dark metallic green, the under surface black. It does great injury to turnips. This species is also found in flowers, appearing with the germinating bud, and remaining until the blossoms fall off. If disturbed in cloudy weather, they suffer themselves to drop to the ground, but at any attempt to dislodge them in sunshine, they fly away. The habitations of these insects vary according to the species, and it is a difficult matter to extirpate them from the places where they once settle, as they are certain to appear there every year. The turnip fly will devastate whole fields, and the only remedy against such depradations is found in the change of husbandry or the strength of the plants.

The *Sexton* or *Burying Beetle* (necrophorus vespillo), plate 22, fig. 3, is from two-thirds to seven-eighths of an inch long, and four in breadth; black, with two orange-colored transverse bands. It creeps and flies with great rapidity. When a dead mouse, etc., is discovered in their neighborhood, these insects come in parties of a half dozen, and running round it, some seem to be measuring the carcass, while others are busily rooting in the earth to find out what impediment, such as stones, etc., may be in the way. Having found a place that offers no obstruction, they creep under the carcass, and with their united force drag it thence. They next dig away the earth from beneath the dead animal until the hole is suf-

ficiently deep to receive it, accomplishing the work so rapidly that in three hours it is entirely buried out of sight, having first deposited their eggs within the carcass, which is to serve the larvæ for food.

III.—Melasoma.—Mold Eaters.

These insects have mostly an oval body with acute corners, nearly covered with hard elytra, a large thorax and small head, with the mandibles notched and the antennæ thickened at the tip; the teeth are thick, large, and mostly toothed. They live on decayed vegetable matter, manure, rotten wood, etc., in which they lay their eggs; some also feed on leaves and buds. They are divided into three families, namely, Mushroom, Wood, and Ground Beetles.

1.—Fungicola.—Mushroom Beetles.

Are mostly small beetles, with tarsi of three or four joints, short antennæ, and live in damp places.

The *Dark-brown Mold Beetle* (lathridius porcatus) is nearly a line in length, smooth and dark brown, antennæ and feet also brown; on each elytra are eight small stripes. These insects live on vegetables or other substances in damp cellars, where they can feast on the white mold that collects in quantity in such places, keeping always on the lower surface of the article they are preying upon; therefore they often fall upon their backs, from which position they have some difficulty in recovering on account of their short legs.

The *Common Mushroom Beetle* (scaphidium agaricinum) is oval, and scarcely a line in length, shining black,

with pale brown antennæ and legs. The elytra are somewhat short. These insects come in autumn, and are found in great numbers on decaying fungi. They run with great activity.

2.—Insects Living in Boleti or Rotten Wood,

Are of an oblong form, with the thorax nearly square; the head is capable of being withdrawn, the antennæ granulous, on the two fore feet are five, on the hind four joints. They feed on farinaceous matter, viz., meal, the dust of fungi, or decayed wood.

The *Tenebrio* (helops ater) is three lines long, and dotted with black, antennæ (feelers) and legs brown; found in the decayed trunks of old willows. Its larvæ closely resembles those of the meal worm.

The *Meal Bug* (tenebrio molitor) is oblong, measuring about seven-tenths of an inch, chestnut-brown on the under surface, but dark and shining on the back; frequently found in mills and bake-houses, where its larvæ are known by the name of meal worms. It is scarcely possible to get rid of these troublesome insects when once harbored, for the larva will gnaw its way through wood and hide in the meal chests. As the meal worms are dainty food for nightingales and other insectivora race, kept as parlor birds, they are preserved in the following manner: A wooden box, or rather a large earthen pot —since the larvæ will eat their way through wood—is selected, the bottom is covered with a thick layer of bran, above this is a woolen cloth, and so on until the mass is as high as requisite. In the month of May the worms and beetles are placed in these vessels; a hole is made in the uppermost layer, through which two tablespoon-

fuls of water are poured; this is repeated as often as the composition becomes dry. It is kept damp but not wet, as too much moisture would kill the worms, the pot placed in a moderately warm spot, and disturbed as little as possible.

3.—Ground Beetles.

These are mostly large, with arched oval bodies; the head is broad, the thorax elongated, thighs broad and serrated; the tarsi are five-jointed, and the wings lammelate. They are fitted with hard skins and feet, suitable for digging, lay their eggs in manure or mold, on which the larvæ subsist for a long time before their transformation; some, however, feed on leaves and flowers.

The *Pencil* (trichius nobilis) resembles the gold bug, but is smaller and more globular. This beetle lives in umbelliferous plants, the larvæ in the fungi or decayed portions of plum trees. In April they enclose themselves in a ball made of earth and rotten wood, from whence, in the space of four weeks, they come out as a perfected insect.

The *Gold Bug* (cetonia aurata) is nearly an inch long, of a brilliant green and gold color, with fine white marks on the elytra. It is common in our gardens, where, found on roses, it is called the rose beetle. It lays its eggs in hollows of trees, principally, however, in places where wood is decaying. The larvæ are often met with in anthills. The larva makes for itself a ball of earth and decayed wood, cementing it together with an adhesive substance secreted by itself, and which causes it to become so hard that it can only be opened with difficulty. Enclosed within this structure the creature under-

goes the transforming process and comes forth in May or June a perfected insect.

The *May Bug* (melolontha vulgaris) is one inch long, black, with brown elytra, the tail is pointed somewhat in the form of a beak. In many the thorax is brown, like the wing cases. These insects may be observed on the warm evenings in May—some years in great numbers—flying round; their motion is accompanied with a buzzing noise. They are therefore very injurious not only to fruit but forest trees, which, as they are very voracious, they strip entirely of verdure. The female, distinguished by her smaller feelers, deposits her eggs in the earth, from which a grub or maggot comes forth; these grubs may be found under stones or tufts of grass, in fields and meadows, often new-turned earth. They have a white body and red head, and are eagerly sought after by young anglers and birds. They live on the roots of plants and grass, and, committing great devastation in the fields, are a great nuisance to the farmer. The best way to get rid of them is to cherish ground moles and insect-eating birds. Moles, burrowing in the earth, feed upon them without injuring the roots; and birds, following the course of the plow, pick them up eagerly as soon as the earth is turned up. There is a smaller species, called by the Germans Brachkafer, that comes in June, after the cockchafer or May bug has disappeared.

The *Sacred Beetle** (scarabeus sacer) is about the size of the horse beetle, very black and smooth, the head is shield-shaped and finished neatly with six notches in the anterior edge, resembling rays. These beetles abound

* Also termed *Pillularus.*

in Egypt and countries along the Mediterranean; their eggs are deposited in manure or excrementitious matters, which they roll into a ball and shove along with their hind feet and seemingly great trouble to some spot where it can be buried safely. From this intense care in providing for their young, or perhaps the shining rays of their brilliant-colored heads, they were worshiped by the ancient Egyptians, and their representations are found on their monuments. In those early days they were known by the names of Cantharus and Scarabeus.

The *Moonshaped Dung Beetle* (copris lunaris) is nine lines in length; black and glossy; thorax and abdomen of equal measure; the elytra ridged; the head globular, with an erect horn on the front. The males are distinguished from the females by the superior size of this appendage. They feed on dung, are found in sandy places, under which they make holes, where they deposit their eggs.

The *Horse Beetle* (geotrupes stercorarius), nearly as large as a cockchafer, it is of a lustrous black above, violet below, may be seen in evenings flying everywhere, but is more especially abundant in the neighborhood of manure heaps. When touched, the cunning insect stretches forth its legs and feigns itself dead. In bad weather it seems to crawl about rather than fly. The female lays her eggs singly and in the following manner: She makes a hole in the earth, which she lines with manure; here one egg only is deposited and covered with the same material, she then proceeds to dig a number of others intended for the same purpose. Mites are frequently found on these beetles.

The *Bread Beetle* (trogosida caraboides) is three and a half lines in length, black, brown below with the elytra

striated; lives in rotten wood, bread, or granaries, where their larvæ, which are white, leather-skinned, and spotted with dark points, commit great devastation. They abound in the south of France, where they are known under the name of *Cadelle.*

The *Stag Beetle* (lucanus cervus), also termed *Horned Beetle,* plate 22, fig. 14. The males have very large mandibles, curved and toothed like stag horns; those of the females are smaller, from which they receive their name. They live in the oak forests, are most numerous in June or July, and are considered somewhat formidable, as they can wound severely with their pincers. By way of amusement, they are harnessed to little sleighs or wagons made for the purpose, which they draw easily with their horns. Their larvæ was esteemed a dainty by the old Romans. When ready to pass through their transformation, they make a cell of loam or clay, which becomes almost as hard as if burned in a pottery.

The *Rhinoceros Beetle* (oryctes nasicornes), plate 22, fig. 12, belongs to the largest order of European beetles; is more than twelve lines in length; reddish-brown; has a protruding knob on the thorax, which, in the males is furnished with three teeth. The head is surmounted by a long horn, measuring from three to four lines, that curves backwards; the females, instead of this cornuted appendage, are distinguished by a knob or wart; the under portion of the body is hairy. The eggs are deposited in tan, rotten wood, or dung heaps; the larvæ undergo their metamorphosis in a large, smooth cave, formed by themselves in the earth. These beetles, which are by no means common, appear in June or July.

The *Hercules* (oryctes hercules), plate 22, fig. 16, is more than five inches long, and brownish-black; the

head small, and, in the males, together with the thorax, is extended into a long, serrated horn; that, protruding from the latter is the longer of the two, and the other is suitably fitted to meet it. The elytra of the males are brownish-gray, spotted with black; the antennæ are small, eyes yellow; the border of the body hairy; found in the West Indies.

The *Acteon* (oryctes actæon) is considerably larger than the Hercules, and therefore the largest of the *Scarabæi;* dark brown, abdomen hairy, and feet provided with prickles. On the head is a long, curved horn, bending outwards; two smaller are found protruding from the front and sides of the thorax. The females have tubercles on the head instead of horns, and the thorax is formed of folds or leaves.

THIRD ORDER.

ORTHOPTERA.—CRICKETS—BUGS—LOCUSTS.

The insects belonging to this order do not all undergo the same regular metamorphosis as those which have already been described. Those which rank among the transparent-winged, pass through a certain change, and have the wings and elytra perfectly developed and bright colored; others, undergoing a partial metamorphosis, have them imperfect, and in some they are found wanting altogether.

The *Ear-wig* (forficula auricularia) is about an inch long; light brown, the elytra are very short; the true wings are long, and so artistically folded together that one is at a loss to conjecture how they can be so completely concealed under those small wing-cases. The

abdomen is terminated by two horny appendages, resembling pincers, and although this movable apparatus has given rise to the popular opinion that by them the insect insinuates itself into the ear, it is not to be credited, for these horns are only raised in self-defense. The earwigs feed on fruit, and are therefore very injurious to fruit trees.

The *Cockroach* (blatta orientalis) is flat; nearly oval, and has the head hidden behind the pro-thorax; the wing-cases are coriaceous, and cover the wings, which, like those of the beetle, are folded under them. These annoying insects are originally from the east; their length is about an inch; in color a chestnut-brown, with reddish-brown wings; these wings are peculiar to the male, the female are without. They remain hidden during the day, but coming forth in great numbers at night, they devour all kinds of provision. Where they are once settled, it is a difficult matter to get rid of them, and they are considered the pests of the kitchen. There is a relative species, called the *Surinam Kakerlac*, found in the West Indies, that constitute a real plague to families.

The *Praying Mantis* (mantis religiosa), plate 26, fig. 10, derives its name from being supposed to fold its forefeet and elevate them in the position commonly given to the hands in prayer. This attitude is, however, by no means devotional, but only a trap to catch insects. It is two inches long; altogether green, and on this account, as well as having large wings, has sometimes been called the *Walking Leaf.** It is found in southern Europe; as soon as a fly approaches this insect, it elevates the

* Leaf Insect (*Foliata*), which, resembling a leaf in color and shape, may easily be mistaken for one.

fore part of its body and fore legs, attentively watching the prey; if, however, it does not come within seizing distance, it creeps slily and cat-like towards it, and, making a sudden spring, secures it. A relative species, but much larger, is found in the East and West Indies.

The *Mole Cricket* (gryllus gryllotalpa), plate 26, fig. 9. This family is distinguished by having the fore feet very broad, flat and toothed-like hands, proper for burrowing. The hind legs, used for leaping, are not very large. They measure an inch and a half, are gray, with brown feet, and have their long wings placed far back on the body. The males make a chirping noise by rubbing their wings together, like the grasshoper. These insects are very injurious to the roots of plants and grass, which they feed upon. Their presence is known by grass plats turning yellow towards autumn, and it is common to trample upon those spots in order to destroy the destructive insects.

The *Field Cricket* (gryllus campestris) is above an inch long, black, and lives mostly in meadows where there are ridges or hillocks, into which they dig holes; peeping out from these retreats while they sing. Two crickets meeting attack each other by butting with the head, like goats; but this seldom happens, as they are timid, and rarely go far from their holes. Lizards are their greatest enemies. Their clear, shrill note is well known. They feed upon all kinds of roots and vegetables, and drink the dew drops. The *Domestic Cricket* which is less, but much resembles the above described, lives in the homes of man, where it does great damage, often cutting holes in articles of clothing, or getting into flour.

The *Tree Locust* (locusta viridissima) is two inches

long, entirely green, with large legs fitted for leaping; long wings, and the posterior portion of the body terminating in an ovipositor. This species harbor among trees or bushes, keeping up a continual chirping, and, sitting quietly, will suffer one to approach closely, but, when the intruder believes himself certain of the prize, the little creature flies off. This family, known by the popular name of the *Great Green Grasshopper*, is always met with on linden trees. Much resembling the green locust, but smaller, is

The *Little Green Grasshopper;* nevertheless, it is a fierce little insect, and bites more severely than the former. In some places the peasants use them to remove warts, from which circumstance they receive the name of *Wart Eaters.*

The *Migratory Locust* (acridium migratorium) is two inches long, grayish brown, spotted with black, or tinged with green; their true home is in Tartary. They are there found in such numbers that in their migratory flights they appear in the distance like a black cloud, which, gathering, obscures the light of day. From time to time they unite themselves in troops of millions, and keeping on a certain track, can, in a little while transform the places where they alight into an arid waste. In Asia and Africa this and other similar species are greater pests than in Europe, although they are there used as an article of food. The manner of preparing them is to tear off the wing-covers and feet, and then bake them with butter; they are said to be very palatable, and taste like crabs. This species of locust is believed to have formed the sustenance of St. John while he abode in the desert.

The *Bed Bug* (cimex lectularius) is flat, without wings, and provided with a straight sucker or proboscis.

These pests are supposed to be natives of southern regions, and brought to Europe, most likely, in timber; be this as it may, they are now very generally spread everywhere. They measure about three lines in length; are egg-shaped; the head very small, and provided with antennæ resembling fine bristles. Their skin is so transparent that, examined through a magnifying glass, the interior organs can be distinctly seen. They run very rapidly. Keeping hid in the daytime, they come forth at night, and fastening on the sleeper, prove real scourges by their stinging and sucking his blood as he slumbers; and when in danger, or crushed, they exhale a fetid odor, almost unendurable. When filled to repletion their color is a reddish-brown, but when empty, are dark gray. Great cleanliness and extreme vigilance are the best means of keeping clear of these noxious insects. It is also very well to anoint the bedstead with corrosive sublimate or spikenard, as they will not harbor where these articles have been used.

The *Half Winged Garden Bug* (lygaeus apterus) is distinguished by having only elytra and not wings; it is a small bug, four tenths of an inch in length; found in gardens, and at the foot of trees, and is of a handsome cinnamon color, dotted with black. These insects pass the winter under the moss, or in the crevices of trees, coming forth in the summer. They are not attended by an unpleasant odor like others of the same species; the sap of fallen leaves and dead insects serve them for food.

The *Berry Bug* (cimex baccarum) is nearly half an inch long, oval; the wings composed of something resembling skin and parchment; of a gray color, with yellow lines. It is found, mostly in the latter part of summer,

on all berries, to which it imparts its own unpleasant odor.

The *Water Bugs* (hydrometra lacustris) are slender insects, with long legs; bodies scarcely half an inch long; frequently seen skimming on the surface of the water during the summer. The color is black, but covered with a silver luster; they have no wings. They feed on gnats and other insects, and pass the winter in the mud under the water. When crushed they emit the same disgusting odor as the bed bug.

The *Swimmer* (notonecta glauca). The body is cylindrical, and measures nearly an inch; yellow-gray; the upper wings are spotted on the borders with brown; the corselet is black; the hind feet are long and hairy. These insects may be seen in summer time, mostly in standing water, where they swim or row with great quickness, and often on their backs, whence their generic name. They fly up out of the water, and then fall back again with a sudden plunge, as if a stone had been thrown into the pond. As they sink beneath the surface, silver-glancing air bubbles may be observed adhering to the hairs on the posterior portion of the body; if placed upon a dry spot, they make (as crawling on a level is painful) all possible efforts to reach some elevated body, in order to spread their wings and find the way to the water. They have a sharp proboscis with which they can prick sharply, and make use of it to kill the water insects and larvæ of frogs, the blood of which serves them for nourishment.

The *Scorpion Bug* (nepa cinerea) is flat and oval; the head small, with protruding eyes, the abdomen light red, black in front; brown on the posterior portion of the body; head, breast, feet, and fore wings ash gray. The fore feet are large, heavy, and forked; placed far

forward, and consist of five joints, of which the third is the largest. These insects are lazy, swim and creep slowly on the bottoms of ponds or stagnant waters, occasionally grappling on the roots of plants. It is easy to capture them, but is not often attempted, as their sting is severe as that of a bee; they prey upon insects, even those of their own race, seizing them with their fore feet and wounding them with their sharp proboscis, suck the blood of their victims most greedily.

The *Singing Grasshopper* (cicada plebea)* on the back is shining brown, dirty yellow below; the breast-plate is marked with a red cross; the length of the body exceeds an inch; the head is short and thick, the wings transparent, the antennæ very filamentous, the legs of equal length, none of them being formed for leaping. The males have a kind of drum, formed of two oval cartilaginous plates; these, placed on the under surface of the body, near each other, and moved by muscular power, strike together, and produce a monotonous and noisy kind of music. The *Cicadariæ* are pretty little insects, and were known in very ancient times, doing little injury to plants, although feeding on their juices, and are generally favorites with man, on account of their cheerful and continued songs; the most are natives of southern regions.

The *Foamer* (cicada spumaria), about the size of a flea, brown, with four pairs of large white spots on the front wings, which, however, are sometimes rather indistinct; the head is broad, rather than long, only on the lower surface it is extended into a proboscis or sucker. The hind legs are long and prickly; they can leap over

* Called *Katydid* in the United States. The French call them *Chanteuses*, or singers.—*Tr.*

a space of five or six feet, and in making this movement, produce a crackling sound; in the month of September they may be found in hedges everywhere. The larvæ of these cicada are of a yellow-green color, and furnished with six feet; they run rapidly and leap well; live in companies on plants, and derive their nourishment from the sap, which they suck. They draw forth more of the vegetable juices than serves them for food; the rejected portion assumes the appearance of froth or foam, and is often accumulated into small heaps, from which hangs a drop of clear, honey-like fluid, vulgarly termed *cuckoo-spittle.* In the larva and nympha state this foam serves them for a receptacle in which their metamorphosis is accomplished. Various species of cicadariæ are found in South America, uttering constantly their monotonous sound, which resembles the sound made by the running down of a clock.

The *Surinam Lantern Bearer* (fulgora laternaria). This large and beautiful specimen of the genus cicada is three inches long; has legs formed for leaping, and wings resembling those of the locust; on the front of the head is a large illuminous globe, of a membraneous texture, called the lantern, which, in the night, diffuses so strong a phosphoric light that persons are enabled to read conveniently by the aid of two of these insects. This is a popular belief, but how far entitled to be credited is not proved. Its color is olive-green, variegated in the form of white stripes and marks; the lower pair of wings are decorated by large, brown, eye-shaped spots; it is a native of Surinam, but is very rare. There is a similar species found in China.

Equally rare is

The *European Lantern Fly* (fulgora Europæa), five

lines long, one in thickness; altogether green; the wings long, transparent, and veined with green; the straight and pointed horn on the forehead, prolonged into a muzzle, has three ridges above and five below; the abdomen is large, resembling that of the house-fly, ending in a forked point. Found in the south, but not unfrequently as far north as Germany.

The *Leaf Louse* (aphis) is a little round insect, which is sometimes provided with wings and tubes, which, situated in the posterior part of the body, are fitted for the reception of honey. The aphidæ are more sluggish than any others of the Parasita, and are found by thousands, clustering on the juicy stalks of different plants, which they injure by piercing the twig with their sharp sting and sucking the sap. They are variously colored, some are green, some brown, others black, and their increase is rapid and immense, almost beyond belief. It is remarkable that the males, which are winged, only appear in autumn. The females form the large societies found clustering together. Some produce living young, others lay eggs. Their increase is wonderful; one individual, it is said, will produce twenty broods in one summer, and as every five generations number six millions, it may be supposed what devastation such numbers would cause in a garden, if they were not destroyed by other insects. The ants pursue and feed on them for the sake of the transparent saccharine fluid, termed honey dew, which exudes from their bodies. One species, which lives on pines, by puncturing a vulnerable part, produce monstrosities, having the appearance of galls, within which both insect and larvæ dwell.

The *Leaf Fleas* (chermes), called also by the French *False Plant Lice*, are very small insects, resembling

fleas, which, like the aphidii, live on the sap of leaves. Both males and females have broad-plated wings; the breast plate is curved, the antennæ long, the feet double-jointed. The hind legs, although shorter than the fore, are arranged for leaping, in which movement the wings assist. They are very lively, and on the least movement of the leaf will hop off. In their characteristic usages they are like other insects, passing the winter in the perfect state, and depositing their eggs in April. Many varieties exist, being found on pear, fig, beech, and ash trees, as well as on the nettle and alder. They are, however, less numerous than the plant louse.

The *Cochineal* (coccus cacti) are small insects, not unlike the preceding, about the size of a large pin-head; the whole body is filled with rose-colored fluid. They are found upon the species of cactus known by the name of the Indian fig. The females envelope their eggs in a kind of cottony secretion, which serves them as a nest. The males are provided with two transparent wings, the females are without. Their true home is in Mexico, where they are tenderly cherished and carefully protected from cold and wet. The celebrated crimson dye produced by them is highly treasured, being one of the chief sources of the riches of Mexico, and is much improved in brilliancy by this careful tending of the coccus. This coloring material is well known to every one by the term Carmine. Several crops of these insects are gathered from off the plants in a year, and it is astonishing to see how rapidly they increase. The manner of killing the coccus is by the steam of boiling water. It takes seventy thousand of the dried insects to make one pound of cochineal. The attempt has been made to transplant

them into Europe, and when placed in conservatories, has proved successful.

The *Kermes* (coccus ilicis) is a scale insect, and lives on a kind of prickly oak found in the south of Europe. The males have white wings, the females are without. These insects are, in March, about the size of a millet seed, enveloped in a kind of cottony substance, and resemble a small plum cut in half; by April they have acquired the size of a pea, are round, and instead of their cotton covering, are clothed with a thick white dust, which, being examined, will be found to contain perhaps two thousand pale red eggs, each one about the size of half a poppy seed. They are also used for dyeing. A similar species is found on the roots of plants in Poland, and is termed the *Scarlet Grain.*

The *Gum Lac* (coccus lacca) is also found among the scale insects; scarcely as large as a common louse; the body consists of twelve rings, is oval, nearly flat, and red, with a ridge along the back. The under side is smooth, their antennæ are filiform and extended, each dividing into two or three fine joints, like bristles. The extremity of the body is similarly furnished with two of the same. These insects live on the sap of the banana and jujube trees, the plaso and some mimosas, which is milky and adhesive; this sap, on being exposed, becomes hard like lac, and so strong a bird-lime is made from it by the natives, that peacocks are taken with it. A thick red-colored fluid exudes from the bodies of these insects, which also hardens into lac. The female deposits her eggs within this mass and dies, so that it may be said her own body serves for the first nourishment of her young. They are found in immense numbers and furnish the well known gum-lac, which, partly used as crimson dye,

partly as varnish, is found encrusted on the small branches of trees. In the natural state, this production is termed stock lac; separated from the rougher particles, it is seed lac; these particles collected, melted, and formed into cakes, is lump-lac, and, when again transformed, by further preparation, is found in thin, transparent scales, called shell-lac, the value of which depends on its greater or lesser transparency. The crust of gum-lac found on the branches is half a line in thickness, and in every cell measuring two lines in length, is found entombed the crimson-hued insect, separated from which, the lac is as yellow as amber. Whether this lac is the overflowing of sap caused by the punctures of the coccus, or a secretion exuded by their own bodies, is not decided. A certain tree in China, producing a kind of wax from which tapers are manufactured, is the home of a particular species of coccos which causes this singular exudation.

We now close the description of this remarkable order, and proceed to describe some of the most important of the

Transparent-Winged Insects.

These families are divided into two families: the Aquatic and Terrestrial. To the latter belong

The *Libellulæ* (dragon-flies or adder-bolts), distinguished by their slender bodies and gauze-like wings, which are often beautifully colored and composed of a tracery of the finest net-work. These brilliant insects may be always seen in the neighborhood of pools and brooks, flying with the rapidity of lightning, their bright colors glancing in the sunlight, in pursuit of all other insects, as, being extremely voracious, they are unsparing of their victims. Their teeth and mandibles are

very strong, particularly at the ends. They lay their eggs in the water, where both larvæ and numphæ remain for many months before their perfect development. In the first two states and living in the water, they resemble the perfect insect, except that they have six feet and no wings. They change early into pupæ; this second stage of their being is only distinguished from the first by indications of the rudiments of four wings and a larger growth. Most of the libellulæ are of a brownish-green color; head, breast, and abdomen distinctly separated; they swim well and respire water by means of a lamellar appendage at the posterior extremity of the body. After remaining ten or eleven months in the water, the pupa leaves it and climbs upon a plant, where it awaits its final transformation. After remaining motionless for a time, the skin on the breast begins to separate, and the perfect insect slowly issues from its envelope, unfolds its wings, which at first are humid and soft, to be dried by the air, a process which frequently requires two hours for its completion. The different species of dragon-flies can not, as in most other insects, be distinguished by the color. The race, however, is divided into the following families:

1.—*The Broad Dragon Fly*, with round head and broad hinder body, carrying the wings horizontally extended.

The *Common Dragon Fly* (libellula vulgata), yellow-gray or reddish; wings altogether diaphanous, body cylindrical.

The *Yellow Adder-bolt* (libellula depressa). The males have the abdomen spear-shaped, and of a fine blue color. In the females the sides are spotted, and

the breast striped with yellow; the ground work of the wings is brown.

The *Golden Green* (libellula æna) is of a beautiful golden green color, with black feet and colorless wings; abdomen club-shaped.

2.—*Long-bodied Dragon Flies*, with round heads and very long cylindrical bodies, carrying their wings as the genus described above.

The *Great Dragon Fly* (æschna grandis), plate 26, fig. 1, is two and a half inches in length, spotted orange and green, the corselet striped with yellow, with transparent wings.

The *Black Dragon Fly—Devil's Needle* (æschna forcipata) is something smaller; black wings, which are yellow below, but spotted brown on the borders.

The *Ephemera* (ephemera) have the limbs five-jointed, the eyes close together, and no jaws, like the libellulæ; they carry their wings perpendicularly. The antennæ are short, two or three filaments or bristles found at the posterior extremity of the body very long. Their larvæ do not form an envelope in which they await their metamorphosis, but burrow in the banks of streams, and feed on the mud. They have large branchiæ on each side of the abdomen, through which they respire. The most remarkable is

The *Ephemera Proper* or *Shore Fly* (ephemera swammerdammi), which has a body more than an inch long, terminating with filaments at the posterior extremity of the same length. These insects usually appear in great swarms on the bright days in summer along the banks of rivers, sometimes for two or three days, but the duration of life in most, as their name denotes, is limited to a single day. Scarcely have the larvæ quitted the

water, than they cast their skins, and deposit their eggs in a gelatinous mass, resembling two balls of spawn. From these proceed small grubs, which, although able to swim with serpent-like motion, mostly lie hidden in galleries, varying from two to three inches in length, formed in the mud of the shore, which also serves them for nourishment. When they have attained to the size of a small finger, they pass into the nympha state, and, easily distinguished by the rudimentary wings, are used as bait by the fly fishers under the name of the shore worm or gray drake. They sometimes remain years in the larvæ state before the final metamorphosis is completed.

The *Water Moths* (phrygæna) have long antennæ, tile-formed, hairy wings, the hinder pair mostly folded longitudinally. The legs are five-jointed; they have more than one pair of eyes, one pair of which, placed on foot-stalks, are without the posterior filaments; the mouth is too minute to be discernible. The imago proceeds from a larva which respires through branchiæ, and forms a cell, in which its transformation is accomplished. The caterpillar-like larvæ are very numerous, live in the water; they envelope themselves with a silky covering, which they plaster outside with all kinds of material, which gives them a very rough and singular appearance, resembling leaves, twigs, roots, etc.; these receptacles are enlarged as the pupa increases in size. They live on the leaves of different water plants, preferring the water ranunculus. Enveloped in this clumsy screen, they, nevertheless, creep over the earth, or climb up plants with ease; choosing materials, which, lighter than water, they can sink at pleasure. These cells have two openings, one at each extremity, which, during the pupa state, are guarded by a kind of silken lattice-work,

which allows free passage for the water and excludes enemies. They live in ponds and standing waters, but mostly go on land to await their metamorphosis.

To the *Terrestrial Transparent Winged* belongs, first,

The *Ant Lion* (myrmecoleon libelloides), plate 26, fig. 5*a*, 5*b*, which measures more than an inch in longitude; has long, hanging wings, with dark brown spots, and short, club-like antennæ; somewhat resembles the dragon-fly, and feeds on soft fruits. It lays its eggs in the sand, from which the larvæ, in time, develope; the larvæ are about three fourths of an inch long, of a grayish-brown color, with three pairs of feet and pincer-like mandibles, which are hollow, and serve as suckers. This insect always moves in a backward direction; therefore, being incapable of pursuing prey, it has recourse to stratagem, which it practices as follows: it digs in the sand a conical pitfall, in the bottom of which it lies concealed, only keeping its jaws exposed. If an unlucky insect, an ant, for instance, comes to the edge of this tunnel, it is almost certain to fall in, when it is at once seized by the jaws of the tyrant, and squeezed to death. Sometimes the poor ant has strength enough to cling to the side of the tunnel, but the wily foe knows how to meet the difficulty, and in such a case never fails to shower sand upon it, which rarely fails to bring it to the bottom of the pit. It is most interesting to watch the contest between the striving insects, the one defending itself bravely, which is, however, unavailing, for no matter how vigorously it may resist, the ambushed foe, continuing to throw up sand with its shovel-formed head, is sure to conquer.

The ant-lion never feeds on dead insects. Before

transformation it buries itself deeper in the sand, where it spins itself a perfectly round cocoon composed of a silky matter, the exterior of which it covers with sand, so that it looks like a sand ball of four or five lines in length. In about four weeks, and towards the end of August, the perfect insect makes its appearance.

The *Plant Louse Lion* (hemerobius perla) is a very pretty, delicately formed little insect, with an extended body like the *Libellulæ;* the wings are long, broad, and, roof-like, extend far above the body. Their texture is web-like, fine, and tender as gauze; closely veined, and so transparent that the brilliant metallic coloring of the body, glancing from gold to green, is easily distinguished through them. The large eyes are globous, and shine like sparkling gems. The larvæ, one inch and two lines long, are cinnamon color, striated on the back with citron yellow; tawny white below, and slightly hairy; feed on the aphides, and, being extremely voracious, and sucking only the juices from the body, they destroy these insects in great numbers. After fourteen days' existence in this larvæ state, they pass into the pupa, and spinning themselves into a cocoon, await their transformation. In three weeks the perfect insect is developed. There are many relative species.

The *Termites* (termes fatale). The termites, which are generally known by the name of *White Ants*, live in India, Africa, and South America, and before attaining their full growth, resemble the common ant. The perfect insect has four transparent, large, brownish wings, and are as large again as the larvæ; the latter are white, have the form of our small ants, and very sharp teeth. They are as skillful, industrious and provident as the smaller tribes of the ant species, building

themselves dwellings of a globular form, composed of calcareous matter, and very large. The royal chamber occupies the center, and, shaped something like a bake-oven, is the dwelling-place of the queen. This royal ant, when full winged and filled with eggs, is a thousand times larger than the common termite. The white ants live in a community, and are divided into three classes, the workers, which are barely three lines long, the soldiers, half an inch long, and the king and queen, which are the only perfect insects. The workers are supposed to be the larvæ, and the soldiers the nymphæ; the former are the builders, and carry provisions, the latter guard the stores, and, what is singular, there are never found but two perfect insects in one nest. When the larvæ, passing through the pupa state, are at length transformed into the perfect insect, and ready to go forth, they may be seen swarming in the evenings before the rainy season, going off in multitudes to form new colonies. The workers and soldiers, however, never appear, but pursue their labors unremittingly under the earth, or trunks of trees. They commit great ravages in furniture, beams, posts, and, in short, every kind of wood, by boring, forming galleries throughout the inside, but leaving the outer surface untouched, but which, nevertheless, falls to pieces on the slightest stroke. With surprising instinct, however, they cover their operations with a coating of clay, cemented by a peculiar secretion provided by nature, which conceals their depredations from a superficial observation; none ever suspecting their ravages, whilst they are sapping and mining below. They are most destructive in the lightly-built houses of the torrid zone. These mischief-working operations, keeping the outside fair while laboring to ruin the struc-

ture within, is not without a parallel in human nature, and may often be observed in individual life as well as in a social community. The females, filled with eggs, like the larvæ of the palm beetle, are eaten as dainty food. There is a tribe of wandering ants found in Guinea, not unlike the above-described, with yellow breast-plates, and black heads and bodies; and, not less scourges, crawl on the surface of the earth, devour or ruin everything they meet with in their journeyings, wherefore the inhabitants destroy them with arsenic. The cells of the termites are described in many natural histories to be most artistically constructed; this is not so; they are only ill-shaped masses of clay, or, if formed on trees, a wooden lump, in which the ligneous body of the trunk or branch is curiously hollowed into cells about the size of a chestnut, in each of which a young ant is deposited, and the openings closed with a filamentous covering, so as to insure its safety.

FOURTH ORDER.

BUTTERFLIES.

The *Lepidoptera* or *Butterflies* are distinguished from all other insects by having their beautiful wings covered with a scaly dust which renders them opaque. In themselves, they are colorless and transparent, and if rubbed between the fingers lose that beautiful dust which gives them their opacity and brilliancy, leaving them pale and diaphanous, like those of a fly. Being closely examined, in a microscope, this dust appears to consist of small leaves resembling the petals of the succory blossoms, and, fixed on the wings by their minute

foot-stalks, assuming on the borders the form of scales or hairs. The head is furnished with two large eyes, which, seemingly composed of fifteen thousand cornea, resemble the facets of cut glass. Butterflies have no teeth; a proboscis, which can be contracted or extended at pleasure, serves them for extracting the sweet juices of trees or flowers on which they feed, and is composed of two tubular filaments lying close together.

These insects undergo the most complete metamorphosis; first, the egg from which proceeds the well-known caterpillar. Some kinds of these larvæ are social, and spin for themselves a common nest in which they live together, until they are able to come forth and sustain themselves singly. Most of them have eight pairs of feet; three pairs, the forelegs or feet, are covered with a horny substance, resembling scales; four pairs, situated in the middle portion of the body, are membraneous;* the last pair are situated at the posterior extremity.† Some—the *Spanners* or *Measurers*‡—are without the middle or membraneous feet, and walk by seizing hold of the object with the six fore feet, and, elevating the body into an arch, bring the hind feet close to the others, and disengaging the first, repeat the maneuver; their mode of progress is too well known to require a more minute description. Most of these caterpillars are are of brilliant color; some have soft naked bodies, others are hairy, tubercled, or spined; some soft and downy, others coarse and bristly. Peculiar species feed on the leaves of peculiar plants; others are not particular, but

* In the perfect insect these membraneous feet disappear, leaving but six visible.

† Called by the Germans *Nachschieber.*

‡ *Geometra* or *Loopers.* Tr.

find subsistence on any that offer. Their maxillary organs are fitted for gnawing vegetable substances, and their voracity is so great that they will in one day devour an amount of food double the weight of their own bodies. When about to be transformed, they prepare a suitable place in which the nympha may await the final change. Every caterpillar can spin, but all do not spin a perfect cocoon in which they are enclosed as in a tomb; many content themselves with attaching silken threads to suitable objects, and thus form a ruder cell. The spinnaret is situated in the mouth; the material used a species of saliva. Every one knows that silk is spun by caterpillars; the single thread, however, like that of the spider, is not a simple filament, but composed of many fine strands. Many of the species, whose spinnarets do not elaborate a sufficient quantity of the silky material to form an envelope for the pupa, attach themselves to leaves, which serves for a defense; others creep into crevices in the bark of trees, and a few remain without any covering whatever. The life of a caterpillar is but a succession of changes until reaching the growth necessary for the pupa state, often throwing off its external covering and assuming a new one. The nympha never alters. The time required for the development of the imago or perfect insect varies, according to the different genera; but the most beautiful and interesting specimen of this wonderful process is to observe the butterfly at the moment of its final transformation. The pupa is seen to move and turn within the inclosing envelope, until at length it bursts, and the perfect butterfly comes forth. If entombed within a cocoon, they discharge an acrid liquid, which softens the silk, and allows its escape. At the moment of its coming forth, the wings are small

and folded together; soon, however, separating, they commence a tremulous movement, in which they seem to grow, but in truth are only unfolding, preparatory to flight. After a short rest they may be seen fairly on the wing, fluttering from flower to flower, sipping honey from their bells. Their perfect life is, however, much shorter than that of the caterpillar and nymphæ, and having enjoyed the sunshine for a brief space, prepares for its posterity as the principal end of its brief existence. The female deposits her eggs, which are hard and horn-like, on plants which she knows well how to select, as affording nourishment and protection to the larvæ. The eggs of most are fastened together with an adhesive substance, and deposited on the leaves and twigs of plants; many cover them with a sort of down which shields them from the air and weather. Having thus provided for the future generation, the butterfly, if not destroyed by some of the many enemies of the race, dies, having fulfilled the ultimate end of her existence.

The caterpillars, with the exception of the silkworm, which are of the greatest use to man in furnishing silk—are a very destructive race; and their ravages would be too seriously injurious to be guarded against, had not nature provided against the evil, by raising up a host of hostile pursuers, which seek them as prey. The insect-eating birds destroy great numbers, but the ichnumon-fly is, perhaps, their most formidable enemy. These little green and gold colored wasps alight on the backs of the caterpillars, and with their fine stings puncture a number of small cells, in each of which they deposit an egg; in a little while a grub comes forth, ready to begin a similar life, and again piercing the flesh of the victim, feeds upon the juices, until the body is entirely exhaust-

ed. There are also flies that lay their eggs among those of the butterfly; and thus the race, which otherwise would be so numerous as to become a pest, is kept within bounds by forming food for the larvæ of bugs and beetles. The butterflies are divided into four families:

I. *Hesperia*, or Evening Moths.
II. *Nocturnæ*, or Phalæna.
III. *Crepuscularia*, Rovers.
IV. *Diurnæ*, or Butterflies.

I.—Moths (*Blatta*).

These are small butterflies, which, avoiding the day, are only seen in the evening; have small and rather flat wings, and but seldom provided with a proboscis. The larvæ come forth altogether unclothed, or covered with almost invisible hairs; they are, for the most part, caterpillars of the grub order, and live concealed, perfecting their metamorphosis in a cell of their own construction. They are divided into three families, the *Tinea*, or true moths, *Leaf Rollers*, and *White* or *Candle Moths*.

I.—Moths.

These are the smallest of the race, with roof-like or enveloping wings, which, horizontally spread, are covered with a shining silvery dust. Their caterpillars make galleries in portions of plants or dead animal matter, on which they feed, or else construct, in a most skillful manner, cases of silk, hair, or skin of leaves. They undergo their transformation in these cases.

The *Pine Moth* (tinea sylvestrella), plate 23, fig. 1,

measures an inch across,* from outspread wing to wing; upper wings, or elytra, reddish-gray, marked with angular lines, the lower brown, and dark on the borders, both fringed on the edges, body reddish-gray. The caterpillar, which is hairy, and at first a dirty olive color, which afterwards changes to gray, lives on the tender branches of the pines, and renders them crooked. Thus, they are very injurious. They envelope themselves in a brown cocoon placed in a crevice of the bark, where they remain all winter.

The *Resin Moth* (tinea resinella) is brown, nearly black; under wings lighter, with pale-fringed borders; upper wings silver-gray, and marked with bands; eight lines in length. The caterpillar, brown and hairy, bores into the fir trees, thus forming galls, in which the brownish-black pupa awaits its transformation, and in early spring comes forth winged.

The *Apple Tree Moth* (tinea pomonella) measures nine lines; body and upper wings gray, striped with brown, and adorned on each side with a coppery, eye-shaped ring; lower wings reddish-brown, bordered with gray; the caterpillar, or larva, naked, and of a pale yellow color, bores into the fruit, even to the seeds, of apples and pears, thus destroying them. In July these larvæ come forth, and fixing themselves in the crevices of the bark, spin a thick, silky cocoon, in which the pale brown pupa remains all winter. They are very injurious.

The *Common Corn Moth* (tinea granella) measures from six to seven lines; the wings are small, fringed, and when at rest elevated behind. Body and posterior

* This measure always relates to the expanse of wings.

wings pale grayish-brown; anterior marbled whitish, yellow-brown, and black. In May they deposit their diminutive eggs in the grains of different cereals. In a week after, the little yellowish larva makes its appearance, at first feeding singly on the grain in which it was hatched, but afterwards a number spin themselves together in a mass, constructing a silken web, behind which they conceal themselves, closing up the opening with excrementitious matter. About the end of August, they crawl into the crevices of the posts or beams of the granary, where they envelope themselves in their cocoons.

The species known as the white corn worm is very destructive; the usual method of getting rid of these vermin, is to turn over the grain frequently, and sprinkle it with salt.

The *Clothes Moth* (tinea sarcitella), six lines in length, with silver-gray wings, thread-like antennæ, and two short probosci. As soon as the little larvæ emerge from the egg, they begin to clothe themselves, selecting furs or woolens for that purpose. Thus enveloped, it may be supposed that the body outgrows the garment, and such really is the case; but, instead of deserting the old tube and forming a new one, they lengthen it at one end as they grow, and slit it in order to increase its diameter, by adding another piece. If formed, at first, of gray cloth, the little cocoon will be gray, if enlarged with the wool of red, the patch will retain the color of its original. The wool of clothes and hair of furs not only serves these little destructives for a covering, but also for food, which they prepare by some singular process of softening, peculiar to themselves, and thus destroy whatever they harbor in. When fully grown, they undergo their transformation, mostly in chinks or cracks

of wood, and perfected in three weeks, come forth as winged insects. They are too well known as the scourges of woolens and peltries to require further description.

2.—The Leaf Rollers (*Tortrices*),

Have horizontal or roof-like wings. The larvæ are smooth-bodied, and never live in the open air, but either singly or in companies, in leaves, which they roll up or convert into tunnels. The metamorphosis is effected in cocoons, shaped like a boat.

The *Pine Leaf Roller* (tortrix buoliana) is nearly an inch long, with small, yellowish-red wings; the superior pair are transversely striped with silver-white; the inferior are shining white, glancing into a coppery luster; the corselet reddish-yellow; abdomen gray-brown. The caterpillars, very injurious, are brown, with black heads, and live on the sap of the young pine trees, into which they bore. Many live together in one nest, which they make upon the tenderest sprouts of the branches. They pass the winter in the pupa state; the nymphæ are long and of a dull yellow-brown color.

The *Beech Leaf Roller* (tortrix prassinana), plate 23, fig. 3, is over an inch in length; body and anterior wings yellow-green, striped alternately with bright red and yellow, the lower wings brownish. The larva, also, measures an inch, is smooth and green, rolls the leaf of the beech into a sort of tunnel, in which it lives. Entering the pupa state in October, it spins an orange-colored cocoon of a boat shape, and when it comes forth, presents a setaceous, but handsome, violet brown butterfly.

3.—Candle Moths.

The wings are divided into partitions; the legs long, and fitted with a kind of spurs. They fly but seldom in the day-time, and undergo the same metamorphosis as the butterfly.

The *Ghost Moth* (alucita pentadactyla), plate 23, fig. 4. Wings composed of five feathers; length, one inch; altogether white, and very delicately formed. The caterpillar is pale green, with a yellow head, and somewhat hairy; lives on black thorn and plum trees; adheres to walls, etc., in the pupa state, and, after remaining thus for a fortnight, the green, somewhat rough nympha, comes forth a winged moth.

II.—Phalæna.

Wings broad, horizontal or roof-shaped; feelers filiform or pectinated; body more or less hairy. The caterpillar is smooth or hairy, with five or six pairs of feet; undergoes the transforming process in a cocoon, sometimes above, sometimes below the earth or in the open air. They fly by night.

1.—Geometra.

The antennæ are bristle-like, sometimes feathered; proboscis recurved, wings horizontal, seldom erect; caterpillar slender, cylindrical, smooth, and provided with five or six pairs of feet. They feed by night; their attitude of repose is singular; extended along the stem or branch, which forms their home, they so closely resemble the little twigs of the plant whereon they rest,

that it is easy to mistake them for wood. They undergo the transition state in cocoons very slightly covered with silk, under leaves or in the ground.

The *Pine Surveyor* (geometra pinaria), plate 23, fig. 7. Fourteen lines in length; males have wings of a brownish-yellow, bordered and striped with black, antennæ slightly pectinated; females reddish-brown, edged with darker brown, and striped transversely. These insects make their appearance in the spring, and remain until the summer. The caterpillar, which is yellowish-green and measures fifteen lines, commits great ravages in the pine forests. They accomplish their metamorphosis under moss; the nympha is at first green, but afterwards becomes of a shining brown.

The *Frost Moth* (geometra brumaria). The males are over an inch long, possessing strong, gray-brown upper wings, which are rounded off; the lower are paler. The females have only slight rudiments of wings, and deposit their eggs in the neighborhood of the buds of fruit and forest trees. The caterpillar, seven lines long, is green, with three yellow stripes and a brown head, is very injurious, and changes under the ground to a light brown pupa.

The *Linden Moth* (geometra marmoraria), two inches long, has white wings; the upper pair are dotted with dark points and bordered with white; the antennæ of the males are light brown, those of the female white, ringed with black. The caterpillar, two inches in length, with two knobbed protuberances on the posterior portion of the body, lives on the poplar, willow, beech, and linden, and when ready for transition into the pupa state, enters the earth.

Geometra Alniaria measures seventeen lines, with

two oblique brown stripes upon the fore wings; on each of the posterior wings is a large moonshaped spot of brown; the caterpillar, also brown, is two inches long, lives on the alder and birch, and with its brown, rugged, ligneous-looking body extended along the branch, may be easily mistaken for a dry twig. It changes in the summer to a brown pupa, and makes its cocoon in the earth or under leaves.

The *Birch Surveyor* (geometra betularia). Two inches long; is yellow or greenish-white, with numerous dark points and stripes; the antennæ of the males feathery. The caterpillar, from two to two and a half inches in length, is very handsome; lives on different trees and shrubs; always changes its color after feeding, but, when stretched out to rest, resembles a dead twig. It does not assume the pupa form until late autumn, when, as a nympha of a dark brown color, it undergoes the transition state in a smooth hole in the earth, coming forth in May.

2.—Noctua.

The butterflies of this family are tolerably large and more brightly colored than the Geometra or Loopers; head large; antennæ often pectinated; proboscis very short; body hairy. The caterpillar is flat, seldom hairy, and mostly dark colored. Enclosed in a cocoon, they pass the transition stage in the earth.

St. John's Bird (noctua jacobæa) is an inch and a half long; black and very common; the upper wings, dark brown, have each a stripe and two eye-shaped spots of carmine color; the under wings of the latter color, bordered with black. The caterpillar, ringed alternately yellow and black, lives in the flowers of the St. John's

Wort, and changes in the earth to a pupa of a reddish brown.

Noctua Delphinii is nearly of the same size as the above. Upper wings purple, marked with rose red; lower pair grayish-blue, with yellow borders. The caterpillar, an inch and a half long, violet-gray, striped with yellow, and dotted with black, lives upon the wild larkspur—many of the species receive their names from the plants on which they feed—and in autumn changes into a dark brown chrysalis, from which the imago emerges in May.

The *Silver Moth* (noctua argentea) is above an inch long; upper wings green, with silver hued stripes; lower white, with large green half-moon spots and white border. The caterpillar is greenish-yellow, and is found in late autumn; lives in the field mugwort. It makes a large cocoon, which encloses an ochre-colored pupa.

The *Dagger Moth* (noctua psi). The butterfly is an inch and a half long; gray, and the upper wings marked with black, one of which is shaped like the letter ψ. The caterpillar is black above, gray, marked with red, below, and has a long, cone-like knob on the fourth ring. In autumn it makes a cocoon or web under dry leaves, and changes into a reddish-brown pupa.

The *Knotgrass Moth* (noctua rumicis), plate 23, fig. 8. More than an inch long; the upper wings are bluish-gray, marked with white and black; lower wings yellow-gray. The caterpillars, black, and marked with yellow, red, and white, are ornamented with tufts of red hair, and live on cabbages and sorrel. They pass the pupa state in the crevices of wood, covered with a web of their own making. The nympa is dark brown.

The *Agate Wing* (noctua meticulosa). Two inches

long; the color is reddish-gray, green, and brown, in wavy panels, beautifully marked; tufts of hair on the breast-plate. The brown or green caterpillar, with irregular white lines on the back and yellow stripes on the sides, lives on mallows, cabbage, celery, etc.; eats only at night, and conceals itself in day time under the leaves. It passes through its tranformation in a web under the earth, which retreat is covered with bits of leaves and sand. The pupa is dark brown.

The *Gamma Moth* (noctua gamma). About the same size with the above; upper wings brown, with a brilliant metallic luster of copper, silver, and gold, intermingled and beautifully marked with light and dark lines; underneath is a white γ, from whence its name; the lower wings dull yellow. The caterpillar, one inch long, is green, and covered with short hairs; is very common, and feeds upon all kinds of vegetables, particularly flax; found living in companies, and therefore do great damage. They make a transparent case or web upon the ground, where they enclose themselves when ready for their metamorphosis. The pupa is green at first, but afterwards changes to dark brown.

The *Copper Wing* (noctua chrysitis) exceeds an inch in length; upper wings of a brilliant copper color, with large black spots; lower wings and body brown. The caterpillar resembles the above described; lives on hoarhound, mint, and nettles. The pupa is olive-brown. This butterfly is very rare.

Red Winged Moth (noctua pyramidea). One inch and a half long; upper wings red-brown, with light, somewhat jagged, transverse lines; the hinder wings are of a copper red. The caterpillar is two inches long; green, with longitudinal white stripes, and on the pos-

terior portion of the body a pyramidal elevation. It lives on the oak, beech, willow, and all kinds of fruit trees. The pupa is reddish-brown.

The *Red Ribbon* or *Crimson Underwing* (noctua sponsa), plate 23, fig. 11, is more than two inches long; upper wings gray, marked with five wavy lines of black and white; under wings of a beautiful carmine red, enchased within a border of transverse black stripes. The caterpiller is marked and spotted with yellow, rusty brown, and gray; lives on the oak; spins a cell between leaves, and changes into a pupa covered with a gray farinaceous substance resembling powder. There are relative species, with scarlet underwings and gray caterpillars, found on willows; some, also, are of a lighter carmine color.

The *Blue Ribbon, Clifden Nonpariel* (noctua fraxini), plate 23, fig. 10. About four inches long; body dark gray; upper wings striped and watered with gray; lower wings dark brown ornamented in the middle with a blue band resembling a ribbon. The caterpillar is of a pale brown or rather ochre color, marbled with brown, and has a knob on the eighth ring. The pupa, like that of the noctua sponsa, is powdered with gray. This species, which lives on the oak, aspen, beech, and black poplar, is very rare.

3.—Spinners.

The body is hirsute; the antennæ mostly pectinated, and furnished with a proboscis. The larvæ have eight pairs of feet, and, from being clothed with hairs, are often called woolly bears. The metamorphosis is accom-

plished in thick cocoons, left in the open air. Many do much damage to wood, which they injure by boring.

The *Puss Moth* (bombyx vinula) is grayish, with zig-zag lines of black on the fore wings, which are also veined with orange; the abdominal portion of the body irregularly annulated or ringed with black. The larva, two inches in length, has its head buried in the first ring as in a collar; on the fourth ring is a sharp-pointed tubercular knob, and the last, just at the extremity of the body, terminates or divides into two movable forked points, which can be bent inwards, from which it is sometimes called the Fork Tail. Its color is pale green; gray above, with stripes of silky white. It lives upon the willow, but in August spins on the earth, and hides between bits of wood a thick cocoon, which contains a short, thick, brown pupa, that comes forth, in May, a winged butterfly.

The *Beech Spinner*, or *Squirrel Bird* (bombyx fagi), is mingled brown and gray above, marked with light and dark zig-zag lines, dots, and points; yellow-white below. Its singular larva lives from July to September on the beech and hazel; the body is yellowish-brown, deeply indented, and with long fore feet; makes a gray, web-like nest in late autumn, between the leaves, where the reddish-brown pupa awaits its transition. This species is rare.

The *Goat Moth* (bombyx cossus) has entirely the color of the bark on which it is found; the abdomen is ringed with black. The larva, from four to five inches long, lives in the wood of the willow, oak, elm, pear, and apple trees. As soon as the larvæ issue from the eggs, which are deposited in great numbers in clefts of the bark, they work their way into the interior, where they feed

for three years on the wood. They are yellow, covered with hairs of a brown color, shading into red. When fully grown, their metamorphosis takes place in a fine cocoon, formed of the sawdust they make under the bark. The pupa is dark brown, and in three weeks comes forth a butterfly. This species is very injurious to forests.

The *Walnut Moth* (bombyx pudibunda), or *Red Tail*, is whitish-brown, with four brown serrated lines on each wing; abdomen yellow. The caterpillar, yellow and bristly, lives on all kinds of fruit and forest trees. The metamorphosis takes place in August in a double cocoon; the red-brown pupa comes forth in May, winged, and is also very injurious.

The *Vaporer* (bombyx antiqua). The males have red-brown wings; the upper are marked with a few dark lines, and on the lower border is a single white spot enclosed in a brown margin. The female has a thick gray-brown body, but is without wings. Caterpillar gray; black above, with red spots, from which yellow bristles protrude; they live on all kinds of trees and shrubs, and are very abundant. Their cocoons are brownish-gray; the pupa pale yellow, striped with dark brown.

The *Corner Spot* (bombyx gogastima) resembles this species.

The *Processionaries* (bombyx processionea), plate 24, fig. 3, are gray, marked with black. The caterpillars of these insects live in societies on oak trees, are brownish black, rather whitish on the sides, and covered with stiff reddish hairs. They dwell together in a silken tent as long as they live, forming one community, and usually issue forth in the evening in a well-ordered procession. A single one takes the lead, as guide, two others follow,

forming the second line, next three or four abreast, and so on for many ensuing columns, close behind each other, when the leader stops, the others do so also, and having found a suitable tree, they pursue the same order of march until they reach the leaves, which they feed on in the same regular succession. They spin their web a few feet above the earth; it is of a gray-white silky material, having an aperture above and closely fitted to the tree. The hairs of these larvæ are very fine and penetrating, and on being handled, are easily removed; sometimes, when they work their way deeply into the human skin, inflammations and swellings ensue. Those who meddle with their nests are not ignorant of the violent itchings caused by their contact. The best remedy is to rub the irritated skin with the juice of parsley.

The *Lappet Moth* (bombyx quercifolia), plate 24, fig. 2, is of a red-brown and gray color, and when in repose resembles a tuft of dry leaves. The caterpillar, four inches long, is of different colors, has on the second segment a blue mirror-like spot, and on the second anterior ring a small tubercle. It feeds on grass, leaves of cherries, plums, thorn, etc., passes the winter in the open air, spins its cocoon in June, and the dark brown pupa, after three weeks retirement, changes into the perfect butterfly.

The *Lackey Moth* (bombyx neustria), plate 23, fig. 15, also called *White Beech Moth*, is pale yellow, with a dark band on each wing. The caterpillar is found everywhere in Europe, living on all kinds of fruit and forest trees. The butterfly lays its grayish-white, pearl-like eggs in rings around the twigs, numbering from two to four hundred, fastening them by a glutinous substance which they secrete. In April the larvæ come forth and

live in societies under webs of large size upon the fruit-trees, where they devour the foliage of whole branches, leaving them bare. They are two inches long, hairy, bluish-gray, striped on the back with orange. The web is double and of a brownish-white; the metamorphosis is perfected in three weeks, and the bluish-gray pupa is transformed into a gay butterfly.

The *Golden Tail Moth* (bombyx chrysorrhœa) is altogether white, lays its eggs in July on twigs and leaves, covering them with a brown wool, taken from its own body. The caterpillars, which make their appearance in late autumn, pass the winter in webs; at this time they can easily be discovered and destroyed. They are hairy, gray and brown, with white spots and a reddish-brown stripe along the back. They are very injurious to hedges, willows, elms, etc. The brown pupa undergoes its transformation in a white cocoon.

The *Gipsey Moth* (bombyx dispar). Males dull yellow-brown, marked with brown zigzag lines; females larger, yellowish-white, and similarly striped. The caterpillars, black, bristly, with a yellow head and body, spotted with red and yellow, live in societies, feed on the leaves of fruit and forest trees, on which they commit great ravages. The metamorphosis takes place in July; the cocoon or web is large, reddish-white, and placed in crevices in the bark, and after a period of two or three weeks the red-brown, yellow-haired pupa comes forth to begin a new existence as a winged insect.

The *Fir Tree Spinner* (bombyx pini), plate 24, fig. 5, is drab-colored, with brown lines on the upper wings, lighter colored on the lower, so that it resembles a bit of pine bark; remains hidden in the crevices of the trunk by day, flying round only at night. Its large, hairy

cushion-formed caterpillar is very injurious to the fir saplings.

The *Brown Bear* (bombyx caja), also known as the *Tiger Moth;* thorax brown, with two red stripes; upper wings brown, marked with yellow-white; lower wings and abdomen red, spotted with black. The long, thickly-haired caterpillars are black, thinly dotted with red, brown, and blue. In August the butterfly deposits about three hundred green eggs on the under side of leaves; in three weeks the caterpillars come forth and feed on grass, salad, potato-tops, rose-leaves, etc.; the next May they spin a large web, which covers small cocoons, containing the black pupæ. The transitionary stage is accomplished in four weeks, and a winged insect springs into life. The Ichneumon flies are their great enemies.

The *Matron* (bombyx matronula), plate 23, fig. 9, has brown upper wings, adorned with six sulphur-colored spots; lower wings bright yellow, with three transverse stripes of black. The caterpillar is very hairy, and varies in color according to its age. They feed on the leaves of the linden, pear, service-berry, etc., and remain during the winter under the moss. They do not pass into the pupa state until in the spring of the second year. They are also called bears.

The *Great Night Peacock's Eye* (bombyx pavonia major) measures five inches from tip to tip of wings; is dark gray, marked with yellow; nearly in the middle of each wing is an eye-shaped spot of bright blue, yellow, and red. The caterpillars are mostly found on pear trees; they are of a yellowish-green color, tuberculated with blue, from which knobs proceed black hairs. When ready for the transition state, they make a very curious cocoon, being formed internally with stiff, convergent,

elastic threads, which facilitate the escape of the enclosed insect, but prevent the entrance of intruders. There are several smaller species belonging to this family.

The *Silk Worm* (bombyx mori) is yellow-white, with broad, brownish transverse stripes on the superior wings. The caterpillar is pale gray, and called the silk worm. The silken material of which this worm makes its regular cocoon, is a glutinous mass of threads spun from the mouth; these are very tough, can not be dissolved in hot water, and are easily dried in the air. The silk worm came originally from China, where the culture of silk was practiced from very remote ages. Sixteen hundred years ago silk was so dear that the wife of the Roman emperor was refused a robe of silk, as being too expensive a luxury. In the middle ages the eggs of the silk worm were first brought to Europe. In 555, some Greek missionaries, during the reign of Justinian, having penetrated to the northern provinces of China, procured some eggs, which they concealed in hollow canes, and brought to the emperor. They were hatched by the heat of a dunghill, and the larvæ grew, prospered, and formed the foundation of the race in Europe. The culture of silk, however, was but little attended to before the year 600. The caterpillars of the bombyx feed on the leaves of the white mulberry; should these fail they will eat garden lettuce, alder or pear tree leaves, which must be given them twice every day and perfectly dry. The little larvæ are at first brown or dark gray, but gradually grow whiter. The skin is cast several times; they are very tender and so extremely susceptible of cold, that in spring it is necessary to keep them in warm rooms. When ready for the transitionary state, they are fed on the leaves of mugwort. They first spin a large

cocoon of fine silken fibers, and then others of coarser texture, until the minute threads are formed into a ball about the size of a pigeon's egg. These threads are part white, part yellow, very seldom green, and have this peculiarity that instead of raveling or being tangled like those of other caterpillars, they reel off easily. After five days' spinning, the envelope is completed and encloses the pupa; at this time it is necessary, in order to reel the silk, to expose the cocoon to such a degree of heat as will kill the animal, because if allowed to remain a perfect insect, before leaving its cell it discharges a sharp fluid, which injures the quality of the silk, and prevents it from beeing reeled. The silk culture now forms a considerable branch of agricultural industry in France and Germany, and is becoming yearly of more importance in the United States.

III.—Crepuscularia.—Lepidoptera.

The bodies are cylindrical or conical; antennæ elongated or spindle-formed, straight or curved; proboscis mostly very long and slender; wings either spread out horizontally or roof-like. Caterpillars, slightly hairy; more frequently smooth; with or without a horn appended to the tail. Metamorphosis takes place mostly in a slight cocoon on the ground, in the pith of wood, or in the air. They fly in the gray twilight of morning or evening.

1.—The Hawk Moths or Sphinxes.

The body cylindrical, feelers spread outwards, wings roof-like and brilliantly colored. Caterpillar black,

hairy, with eight pairs of short feet; without the posterior horn; metamorphosis occurs sometimes without a web, in the earth; sometimes in a cocoon.

The *Six Spot Burnet—Hornet Moth*—(zygæna filipendulæ), plate 23, fig. 2. The superior wings are olive-green with a golden luster, and six blood-red spots; the inferior are red, bordered, on the posterior edges, with black. It lives in the meadows, is not larger than a fly; the caterpillar is pale yellow, feeds on clover, plantain, etc., and makes a yellow or gray cocoon of cylindrical form, which it fastens on the straw or stems of these plants. The nympha, yellow in the middle, and brown at each end, at the end of three weeks changes into a winged insect.

The *White Spot* (zygæna phegea) is larger; color blue, and shines with a metallic coppery luster; white spots on the wings, and two orange rings on the body; lives in wooded meadows among flowers. The dark brown caterpillar, with red head and feet, appears in July; lives on sorrel, plantain, oak, and hazel leaves; spends the winter in the larva state, and changes to a nympha in the early spring; its cocoon is gray, the pupa reddish-brown.

2.—The Glass Wings.

Body cylindrical; abdomen terminated by a tassel; antennæ slightly curved; wings horizontal and transparent; fly by day. Caterpillar smooth, without the posterior horn; undergoes the transitionary state in the interior of plants.

The *Bee Moth* (sesia apiformis), plate 23, fig. 5, much resembles a queen bee; is black, with a yellow head;

the wings transparent, with brown borders. The caterpillar one inch and a half in length, foul white, with a red-brown head; lives on the poplar, mostly near the root; undergoes its change in the earth, making a cell of sand and bits of sticks; very destructive to poplars.

Broad Bordered Bee Hawk Moth (sesia puciformis) has glassy wings, changing from blue to red; at the base olive-green and bordered with a band of brownish-red; the body terminated by a tassel of hairs. The caterpillar is yellowish-green above, reddish-violet below, with the posterior horn curved; lives on dwarf cherry-trees, scabiosa, etc., and when ready for the transitionary state makes a perforated web on the ground and changes into a dark brown pupa.

3.—Buzzers.

The bodies are hairy, feelers straight; wings very long and spread horizontally; flight quick, and attended with a humming noise, as they flutter about in the twilight, extracting honey from flowers with their large probosces. The caterpillar smooth and thick, have the posterior horn; their metamorphosis is accomplished in the earth.

The *Humming Bird Moth—Dove-tail* (sphinx stellatarum) may be seen towards evening hovering around flowers, sucking their sweet juices with its long trunk; the upper wings are gray-brown, with three transverse stripes, the lower dull orange. The tail bearded and forcated. The caterpillar two inches long, red-brown or yellow-green, dotted white below, with a stripe on the sides; lives on the madder plant, bed straw, etc.; undergoes its transformation in the summer, either free or in

a very slight covering; the pupa at first green, then brown, after a period of four weeks, springs into life a butterfly.

The *Taper Hawk Moth* (sphinx œnothera), body and upper wings grayish-green, lighter or darker, connected by a buckle-like process; lower wings bright yellow, bordered with black; margins framed differently. The caterpillar, marbled black and yellow, instead of the posterior horn has a yellow shield; may be seen in July hovering about the flame of a candle, or over the common or water marigold. Late in autumn it changes to a red brown pupa, in which state it remains all winter.

The *Lime Hawk Moth* (sphinx tiliæ). The body and strongly cut upper wings are pale green, olive, and dull red, distributed in panels; lower wings and tail-tuft yellow. The caterpillar, green and marked with varied lines and dots, lives mostly on the lindens; sometimes found on willow, birch, or fruit trees; changes into a brown pupa, which in the May following is transformed into a winged insect.

The *Evening Peacock's Eye—Eyed Hawk Moth*—(sphinx ocellata) is one of the handsomest butterflies; superior wings light brown, with three dark brown transverse stripes on the posterior side; inferior, rose-red, with an eye-shaped spot of blue, enchased with black on each. When reposing, this butterfly covers the lower wings with the upper, and much resembles a withered leaf. The caterpillar is yellow-green, lives on the willow, blackthorn, linden, etc. Changes into a chrysalis on the earth, without weaving a web; passes the winter as a pupa; red-brown below, black above, and comes forth in spring a butterfly.

The *Poplar Hawk Moth* (sphinx populi); males

gray, veined with ochre color; females reddish-gray, with cinnamon spots on the inferior wings; all the wings pectinated or toothed. The caterpillar, two and a half inches long, is blue-green, marked with yellow; has a blue horn; lives on the willow, poplar, and aspen; changes in August to a pupa, red-brown below, blue-black above; remains all winter in the nympha state; makes its cell under ground, and comes forth in the early summer, perfect.

Spotted Elephant Hawk Moth (sphinx euphorbiæ). The fore wings are pale rose color, marked with olive; the hinder, black, with transverse bands of rose red; the brilliant-hued caterpillar, smooth and naked, lives on the euphorbia; is remarkable for voracity. It spins a slight web, and undergoes its transition either under the earth, or among dry leaves; the pupa is brown, and sometimes comes forth in the following July, and at others not until the second year.

The *Swift Wing* (sphinx celerio), plate 24, fig. 6. On the body and upper wings, which run out to a point, brown, marked with lighter shade, and interlined with white; lower wings red, marked with black. Caterpillar three inches long, brown, with yellow stripes, and eye-shaped spots of blue on the fourth and fifth rings of the abdomen; lives on the leaves of the grape vine. In autumn it changes to a handsome red-brown nympha; remains all winter under leaves, and comes forth a butterfly in spring; it is rare; two other species, the *Medium* and *Lesser Swift Wings*, resemble it.

The *Oleander Moth* (sphinx nerii) is found in Italy, very rarely in Germany; body beautifully shaded into rings of green; upper wings partly pale red. The caterpillar, four inches long, is also green, with one white

stripe on the side; on the third segment of the abdomen are two beautiful eye-shaped spots of cerulean blue; feeds on the leaves of the rose bay, from the particles of which it also constructs its cocoon. The pupa is at first sulphur-colored, afterwards brown, and, after an entombing for the space of four weeks, comes forth in October, ready for flight.

Privet Hawk Moth (sphinx lagustri), upper wings and thorax brown-gray; lower wings and abdomen red, with lines of dark brown. Caterpillar, three inches long, is green, with oblique bands of red and white; spotted yellow over the air vessel; lives on the privet, ash, Jericho rose, or alder; passes into the earth in September, and undergoes its transition in a small cavity spun over with a few threads; the chrysalis is dark reddish-brown, and begins its new existence in the next summer.

The *Unicorn Hawk Moth* (sphinx convolvuli) is very large; brown-gray, marked with blackish lines; has transverse stripes of rose-red on the body. The proboscis is very large. These insects remain concealed in the daytime, but, coming forth at night, fly noisily around. The large brown or green caterpillar is naked, and found in cornfields; lives on the leaves of the bird-weed. Keeps concealed in the earth during the day, and when ready for the nympha state, bury themselves deeper. The pupa, glossy and bright brown, is transformed into the imago in four weeks, but frequently not until the next spring.

The *Death's Head* (sphinx atrophos), plate 23, fig. 13, is the largest and handsomest of the sphinxes; the fore wings are gray, marked with darker lines, and rust-colored spots; the posterior wings are of russet hue, with

two irregular transverse stripes; has a remarkable spot on the back of the thorax, resembling a death's head. When handled it emits a singular noise, supposed to be caused by the rubbing of the palpi or feelers against each other; this sharp sound, heard in the intervals of buzzing, has been considered by the superstitious as a messenger of boding evil. It is, however, injurious to bee-hives. Its large caterpillar is yellow, with zigzag lines of green and blue; has a horn; lives on the jessamine, potato, and leaves of the pear, etc. Remains closely concealed in the daytime, coming forth in the dark only, when it seeks its food. Its first change is in July or August, to a dark red-brown pupa, which in September begins a new life as a perfect insect.

IV.—Diurna—Butterflies (*Papilia*).

Body cylindric, somewhat compressed on the sides; antennæ clubbed at the points, either straight or slightly arcuate; wings broad and elevated, proboscis tolerably long; six pairs of feet, of which sometimes the two fore feet are shortened. Caterpillar somewhat of the millipede form, smooth, or studded with tubercular prominences, undergoing the transitionary process in the open air, or inclosed in a very slight cocoon. This species fly in the daytime only.

1.—Hesperia.

Small butterflies, known also under the name of *Skippers;* the anterior wings somewhat falcate; posterior ones tailed and ornamented on the under side with eye-shaped spots; caterpillars ovate or spindle-shaped;

smooth, and have large heads. The chrysalis hangs suspended horizontally, or by a thread. Their flight is low, near the earth, or among plants.

The *Broom Skipper* (hesperia argus), or the *Blue.* Males blue, enchased with white; under side coppery, with white and black spots on a green ground. Females brown, lower wings ornamented with a row of orange-colored spots; very common in meadows and gardens. The caterpillar, scutiform or shield-shaped, green, dotted with white; changes into a brown pupa, which in two or three weeks comes forth a living insect. Found in the broom or clover.

The *Beautiful Argus* (hesperia bellargus) is of a beautiful light blue, bordered with white; the under side adorned with many eye-shaped spots, and margined with yellow; the upper wings ornamented with spots and one curved line. Caterpillar yellow-green, with red spots on the sides, and a dark stripe along the back. The pupa are at first green, afterwards brown; manner of life like the foregoing.

The *Little Arion* (hesperia arion). Azure-blue with a broad black band; the band of the lower wings ornamented with semi-circular white spots, under side with eye-shaped circlets. Found in meadows in June and July.

The *Green Argus* (hesperia coridon). Body and superior wings green, bordered with brown; brown-gray on the under side, with brown spots; on the lower are a few eyes; wings bordered on their margins with orange-colored spots. The female is altogether brown.

The *Mallow Skipper* (hesperia malvæ). Dark brown; upper wings variegated with white; under yellow-brown, with light and dark spots. The caterpillar is covered

with fine hairs, flesh-colored, with a black and yellow spotted neck; common on the June roses, among the leaves of which it spins an envelope; changes to a dark red-brown nympha, issuing forth in July. The chrysalis of the second generation remains all winter in its cell, and begins its existence in May.

The *Comma* (hesperia comma), yellow-brown, with one light and one dark spot, resembles a comma on the upper wings. The under side light brown, the lower wings dull green. The caterpillar, dull green, is found on pease-straw—called also *Pearl Skipper*.

The *Fire Bird* (hesperia virgaureæ) is flame-colored and black, wing-borders serrated; under side yellow and brown, sprinkled with white and black dots. Found in wooded or hilly meadows in July or August. The dark green caterpillar lives on the wood sorrel and golden rod.

The *Black Gold Bird* or *Ground Skipper* (hesperia phleas). Upper wings brilliant flame color with a broad margin of black and spots of the same color; lower wings dark brown, with a shorter stripe of flame color. Under side yellow, with eye-shaped spots and dotted with black. Found in summer in thinly-wooded places. Also called *Small Copper Moth*.

The *Ducat Skipper* (hesperia hippothœ). Flame-colored with a golden shimmer; on each of the upper wings one dark spot, all four enchased with black and edged with white. Under side gray, with eye-shaped spots of white; the lower wings adorned with hair lines of red. Lives in margin of woods.

The *Kidney Spot* (hesperia betulæ), plate 23, fig. 15. Dark brown, edged with white; on the upper wings is a large kidney-shaped spot of orange color; the posterior

wings end in two short orange-colored flaps. Lower side ochre color with brown bands enclosed with borders of white. The green, yellow-striped shield-shaped caterpillar lives on plum, thorn, and cherry trees; changes into a pale red-brown chrysalis, which in fourteen days again begins a new existence as a butterfly.

2.—Flutterers.

Butterflies of middle size. Wings unicolor or variegated, sometimes transparent and bordered, and again dentated or abrupt. Their flight is at a medium height and with a fluttering movement. Their fore legs are often shorter than the hinder. Caterpillar cylindrical, smooth, or spinous, occasionally, though rarely, hirsute. They seldom make a web; the chrysalis hangs either in a girdle horizontally or suspended by the tail, head downwards.

The *Sand Eye* (tachyptera janira), pale brown upper wings, with a field of orange-brown, adorned with one black eye; under wings with a light band. The under side orange-brown, yellow-brown on the borders, with black eyes. Caterpillar green, slightly hairy, with a white stripe on the sides; lives on reed grass, passes the winter without changing; becomes a chrysalis, yellow-green, striped with black in the next June; three weeks afterwards it is on the wing. Very common in meadows bordering on forests.

The *Hermit* (tachyptera hermyone major), brown with a broad white band, in which a black eye-shaped spot appears on both outer and inner surface of wings; the under side is watered. Inhabits dry, stony places in woods. Caterpillar resembles the foregoing.

The *Large Tree Whiting* (tachyptera cratægi) is white, ribbed with black, and in Germany may be seen in thousands in damp roads and paths, reposing in a kind of benumbed state, when they are easily taken. The hairy caterpillar is gray below, yellowish above, banded with bright orange; measures one inch and a half, is very injurious to fruit trees, on which it lives; remains all winter without changing; becomes a pupa in the spring; the chrysalis is of a yellow-white color, marked beautifully with black; begins its winged life in July. The eggs, numbering from one to two hundred, are deposited on the under side of the leaves.

The *Large Cabbage Butterfly* (tachyptera brassicæ) is yellow, with falcated upper wings, bordered with black, the female differs in having two black spots on the same. Caterpillar one inch and a half long, marked with gray and yellow, is very hurtful to vegetables; changes to a yellow-green, black-spotted pupa, which, for fourteen days, hangs suspended on the twigs of a hedge, after which, the transitionary process accomplished, it flies forth. The eggs are yellow and found on cabbages; the second generation remains in the caterpillar state all winter.

The *Aurora* (tachyptera aurora). The inner surface of the superior wings yellow-white, the outer bright orange with black edges, lower wings irregularly spotted. The large green caterpillar, whitish below, and measuring one inch and a half; lives on wild cabbage, meadow-cresses or the gilliflower, and undergoes its transformation into a pupa, green, and striped on the sides with yellow, which hangs suspended perpendicularly on the stems of plants.

The *Silver Point* (tachyptera edusa) or the *Golden O,*

sulphur color, the margins of the upper wings are edged with borders of black, speckled with white; on each of the lower wings is one round yellow spot, which, on the darker under side, has a silvery luster. Found in June and July on the flowers of wooded meadows.

The *Chess Board* (tachyptera galathea). Yellow-white with general markings disposed like the squares of a chess board on the wings; on the lower surface of the under wings are a few eye-shaped spots, which are brighter in the larger sized female. Caterpillar one inch long, yellow-green with a red head; lives on meadow-clover, etc., and changes into a yellowish-gray pupa, from which, in the summer, is produced the perfect insect.

The *Wood Argus* (tachyptera ægeria). Ground color of the wings reddish-brown; all four adorned with yellow spots and flame colored rings; on the under side marked with one line of yellow and red-brown. The caterpillar, green, and striped with white, appears in May, and changes in August to a short, thick green or yellow-brown pupa, which, suspended by the tail, hangs head downwards. Common in fields bordered by woods.

The *Gold Spotted Flutterer* (tachyptera cynthia), Vanessa, is dark brown, with many yellow spots on both wings; body black; under surfaces red brown, spotted and banded with yellow. Caterpillar also yellow; brown head and longitudinal stripes of black; lives on the sheep sorrel; changes in May to a pale yellow pupa, marked with black, from which the butterfly makes its appearance in June. Inhabits open spaces in woods.

The *Large Mother of Pearl Bird* (tachyptera aglaia) is orange color, with hieroglyphic marks in black on all the wings; the under surface of the posterior wings

green colored, with large spots resembling mother of pearl. Caterpillar one inch and a half long; dark gray, speckled with orange, and covered with long spines; lives upon the violet; changes in June to a pendulous red-brown nympha, from which, in fourteen days, issues a gaudy butterfly.

The *Silver Line* (tachyptera paphia) much resembles the foregoing, differing only that instead of pearl-like spots, the wings are marked with silvery lines. Caterpillar yellow-brown; habits and food the same as above.

The *C Bird* (tachyptera C album), Vanessa. Wings dark brown, strong, and unequally cut; are black, edged with white, and speckled black; in the middle of the pale brown-gray under-wings is a white figure said to resemble the letter C, but in reality its shape is rather that of a V. Caterpillar yellow-brown, and spiny; lives on the hop, elm, nettle, etc.; changes in June to a yellowish-red and gold-speckled chrysalis, which, after fourteen days, is transformed into a butterfly.

The *Little Fox—Small Tortoise Shell*—(tachyptera urticæ). Reddish-yellow wings, with large spots of black; outside margins yellow; inner borders black, speckled with blue; under surfaces grayish-brown, bordered with lighter shades of the same. Caterpillar one inch and a half long, spiny, and variously colored. Is found from spring to autumn upon nettles, and suspended from the twigs of hedges; changes into a chrysalis resembling the above described; after fourteen days the butterfly appears.

The *Large Fox—Large Tortoise Shell*—(tachyptera polychlorus) greatly resembles the above, but is larger and handsomer. Caterpillar mostly black. Lives in great

numbers on the elm, willow, sour cherry, and other fruit trees.

The *Mourning Mantle* (tachyptera antiopa) is reddish-black, velvety, bordered with yellow-white; ground color of wings black, adorned with large blue spots. As soon as escaped from the cocoon, these butterflies discharge a reddish colored fluid, which the superstitious call blood rain. The caterpillars are blue-black, spotted with flame color; live in societies, on the aspen, birch, and willow; change into a pupa gray-brown spotted with red; in fourteen days the perfect insect is developed.

The *Thistle Bird—Painted Lady*—(tachyptera cardui), plate 24, fig. 8, is beautifully marked with angular and circular spots of brown and orange; the under side, still more beautiful, is adorned with a network of lines and eye-shaped figures. The caterpillar, one inch and a half long, grayish-yellow, and covered with spines, lives upon burdock, artichokes, and nettles; grows very fast; changes into a dull yellow, gold-dotted chrysalis; the butterfly comes forth in July, being perfected in fourteen days.

The *Red Admiral* (tachyptera atalanta), plate 23, fig. 12, is velvety-black, with transverse stripes of brilliant scarlet, and white and blue dots on the superior wings; inferior, also black, are bordered with scarlet. The caterpillar, black and spiny, striped with bright yellow, lives on the nettle.

The *Peacock—Diurna*—(tachyptera io). The wings are indented, or cut out on the edges; superior pair, fine red-brown, bordered on the sides with a darker shade; on the anterior margin, marked yellow and black; lower wings dark red-brown, and adorned with an eye-like spot, mottled blue and black, standing handsomely forth

on a lighter ground. The caterpillar, thorny; black, dotted with white; lives in societies, on nettles, during the whole summer; changes into a pupa, pale green, and covered with conical yellow tubercles, which, after a space of two or three weeks, produces a butterfly.

The *White Admiral* (tachyptera sybilla). The male is brown or blue-black; female of a beautiful dark brown-red color, with a white band on all the wings; the under sides mottled. The caterpillar, an inch and a quarter long, with a red head and tuberculated body, lives on the honey-suckle and dwarf-cherry; changes into a brown, yellow-striped, spiny pupa, which, in fourteen days, develops a butterfly.

The *Little Ice Bird* (tachyptera tremulæ), is brown and blue-gray, with spots and rings of cardamine and white. Caterpillar, an inch and a half long, clothed with stiff hairs and spiny tubercles, lives on the quaking poplar, and in July changes to a brown chrysalis, dotted with black. The imago is developed after three weeks.

The *Great Ice Bird* (tachyptera populi). Beautiful dark brown color, with penetrating, regularly-placed spots of white and orange-colored markings towards the border; lower side reddish-yellow. Caterpillar, two inches long, variegated; head forked, tinted red-brown and black; body furnished with conical hairy tubercles; lives singly, on the trembling poplar, throughout the winter; in May changes into a yellow, black-spotted, thorny pupa, from which the butterfly is developed in June.

The *Wood Emperor—Changeable*—(tachyptera iris). The dark brown wings, which, in the male, have a changeable lustrous reflection of blue, are marked with spots of white and eye-like figures of red, which penetrate to the

variegated lower surface. The caterpillar, one inch and a half in length, is forked at the posterior extremity, and has, on the head, two branching horns. Proceeding from the egg in late autumn, it lives, during the winter, on the beech, willow, aspen, and ash, and changes in June into a yellowish, tuberculated pupa, which, after hanging suspended, head downwards, for two weeks, is transformed into a living insect.

The *Apollo* (tachyptera apollo), plate 24, fig. 4. Is one of the handsomest and rarest of the butterfly race. Produced in mountain regions. The body is blackish; wings, yellowish-white, partially transparent, with large black figures; inferior pair, ornamented with eye-like spots, which, white in the middle, are vitreous, and show distinctly on the under side; are enchased with settings of red and black. The finely-haired caterpillar is velvety black, spotted with orange and speckled with blue; lives mostly on the houseleek; makes a slight cocoon, in which it is transformed to a chrysalis, at first yellow-green, but afterwards brown, that after a period of six weeks, comes forth a butterfly.

3.—Æronauts.

Large butterflies, with wings often partially transparent; posterior wings mostly one-forked. Their flight is high, with a graceful sailing motion, only varied by an occasional stroke of the wings, which, stronger than those of the other Diurnæ, enable them to maintain a more continuous and steady flight. The wings of the Æronauts differ from those of all the other Diurnæ, being capable of greater expanse, and admitting of freer action to the body. The caterpillar, thicker in the mid-

dle than at the extremities, is tuberculated. The chrysalis hangs horizontally or perpendicularly; in the first case, by a girdle round the body, in the latter, suspended by a thread. The largest and handsomest are natives of the torrid zone.

The *Swallow-Tailed Butterfly* (æronaut machaon), plate 23, fig. 6. Yellow, striped, and dotted with black; blue spots on the under wings; found everywhere in Europe. Caterpillar, two inches and a half long, is smooth blue-green, with markings of black; lives on celery, parsley, fennel, etc., and has two flesh-colored filaments on the back of the neck, which can be extended like feelers at will. This butterfly may be often seen resting on damp earth, from which it extracts water. The pupa is yellow, and hangs horizontally suspended by a girdle, from which it is sometimes termed the girdle worm. Resembling the Machaon is

The *Surinam Page* (æronauta Leilus), plate 24, fig. 7, except that it is green where the former is yellow; the projecting points of the hinder wings are longer; the green caterpillar lives on the shaddock trees, and is transformed into a white and black spotted pupa, remains fourteen days, and then comes forth a butterfly.

The *Sailor* or *Papilio Proper* (æronauta podalyrius) is sulphur color, with longitudinal black stripes and long spurs on the hinder wings. The larva is green, dotted with red, moves slowly, stretches forth two yellow horns which emit a disagreeable odor; is found on the plum and black thorn. The pupa is grayish-yellow. The handsomest butterflies belonging to this species come from the East Indies and South America; of these perhaps, the first is

The *Achilles* (æronauta achilles) which has dark brown

indented wings, banded transversely with blue. Caterpillar four inches long.

The *Ulysses* (æronauta ulysses), with black-tailed wings, middle space lustrous blue, seven vitreous spots on the posterior edges. This family of butterflies has been divided into two races, namely, Greeks and Trojans, the latter distinguished by the red spots on the breast.

FIFTH ORDER.

HYMENOPTERA.—BEES AND GNATS.

Bees and gnats are distinguished from other insects by having membraneous wings; the former possessing four, the latter but two, the hinder ones being only rudimentary. The families belonging to the bee tribe are remarkable for mostly living in social communities, where they maintain a systematic form of government. In these societies the imperfectly-developed insects are not the servitors as in the ant realms, but are perfectly developed, although belonging to neither sex, and called workers. The first of this race is

The *Honey Bee* (apis mellifica), about half an inch long, dark brown, body overgrown with fine hairs, by which it collects the pollen of flowers. These useful insects are furnished with four transparent wings, which enable them to fly rapidly; their heads are tolerably large, and provided with a trunk or proboscis, which they thrust into the nectaries of flowers to extract their sweet, adhesive juices, and elaborate into honey. The sting, situated at the extremity of the abdomen, is barbed, hollow, and connected with a small sac in the interior of the body, which is filled with an acrimonious

fluid. The queen is easily recognized by her superior size, and the males or drones by the absence of the sting. The honey bees establish their dwellings either in a prepared hive or some cavity, such as are found in hollow trees, etc.; these are skillfully arranged, and it is a most interesting sight to watch a young swarm beginning to found a new colony. One company of workers prepare the interior of their future dwelling by clearing off all incumbrances, another collects materials, such as wax or gluey substances, filling up the crevices so as to exclude damp air or prevent the intrusion of foes; this being finished, they begin the construction of their combs. These, composed of hexagon-shaped cells, formed of wax, constituting a series of little cups, regularly placed in rows, and called honeycomb, are so thin that three or four of these laminæ, laid together, are hardly as thick as common paper. Every mass of comb is an inch thick, and the interval or space allowed between them, admits the passage of two bees abreast. There is never but one queen in a hive, the mother of the whole stock; her only task is to lay eggs in such numbers as is not only sufficient to keep up the population of the community, but to send forth a new colony annually.

The workers are said to be imperfectly developed females, and form the basis of the commonwealth. Flying over the fields, apparently in search of pleasure, they are, nevertheless, usefully employed, and with unremitting industry extract sweet juices from the cups of flowers, which serve partly for their own nourishment, but more especially for the future sustenance of the young larvæ. On returning home thus laden, they deposit the greater portion of their store within the magazine cells, retaining only so much as satisfies their present

hunger. If examined on its way back to the hive, the little laborer will be found to have in the cavity of each thigh two little pellets resembling peas; this, kneaded into its present form by its legs, is called bee-bread, and formed from the pollen of flowers, in which the little creature rolls itself, is the food of the young. The workers, whose task it is also to prepare the wax, retain the sweet fluid they have sucked in their honey bag; this reservoir, transparent and about the size of a small pea, is emptied at once on their return; the wax also is transuded from between the rings of the abdomen. They do more, however, than collect bee-bread and honey for sustenance or knead wax for the forming of combs; they are the guardians of the hive and attendants of the queen. They cluster around her, defend the community against enemies of all kinds, feed the young larvæ, and procure fresh air for the hive by beating with their wings. In short, industrious and indefatigable in discharge of their duties, these unselfish members of the little community seem to allow themselves no rest. Their lives are short, seldom living over eight months; subject to many dangers, such as being devoured by birds or beaten down by storms of wind and rain; as they wander far from home, they are often killed. The queen may live several years, but the drones, the reverse of the workers, being lazy as the others are industrious, caring nothing for the prosperity of the hive, and going forth on warm days only, not to collect stores for the general good but barely to attend upon the queen, are very short-lived, and if their existence is prolonged to August, they are killed by the working bees. These massacres are described as most furious and sanguinary. Thrusting their stings into the bodies of the defenseless drones or biting off their wings,

they kill or thrust them out of the hive, where they perish miserably.

The queen deposits one egg in every cell; the little larvæ appear soon after, and are carefully tended by the nursing bees; as soon as fully grown and they pass into the pupa state, these affectionate laborers close up the cell with wax, and when the *imago* has come forth, which it does slowly, by eating the covering of the cell, they clear away the rubbish.

The queen bees have a natural animosity against each other; if two are in the same hive at once, a furious combat ensues, which continues until one is vanquished, or the community separate into two parties, each having its queen. But as this double rule can not be tolerated in one hive, one party must emigrate to found a new colony; this movement is called swarming. This commotion always takes place when there is a prospect of a new queen being produced from the maturing chrysalis; the old one seeks a new dwelling-place. Her satellites sally forth first, and having found a suitable spot whereon to found their new realm, the queen, on a fine sunny day, flies out from the hive followed by her faithful adherents. The place chosen for settling is usually the branch of a tree, or some other projecting body, where the royal bee alights, and the others cluster around her in a hanging mass, resembling a large bunch of grapes. If the queen is removed from among the rest, and placed in a new hive, it is fairly evident that the whole swarm will follow her, making it also their dwelling; but if the capture is not successful, or the swarm is left unmolested, they follow their queen to a hollow tree or clefted rock, where they construct a new home. When in danger of going off thus, they are frequently made to settle by

beating on some metallic substance, or sprinkling the swarm with a few drops of water from a watering pot; it is supposed that the same instinct which warns them against thunder and rain, induces them to obey this admonition.

Hive bees have many enemies; beside the common insect foes, wasps, mice, wax-moths, and the death's-head butterfly pursue them constantly. Resembling them are

The *Humble Bees* (bombus), which are thick, hairy insects, making their nests in holes in the earth, under moss, etc. These are, however, not constructed with the same neat and artistic skill as those of the honey bees, nevertheless, they collect honey and wax in the same manner, and cherish the young larvæ as carefully.

The *Common Wasp* (vespa vulgaris) is of a citron color, marked with black; one inch long, and makes a nest in the earth, or among hedges—mostly the former —in which some cavity about as large in circumference as a common nine-pin ball, is chosen for the foundation of a kind of city, in which are large spaces that may be likened to streets, and the combs to houses, all surrounded by a wall, in its texture resembling paper. The method of fabricating this material is as follows: they detach particles of old wood or bark with their mandibles, reduce and moisten them to the consistence of a kind of paste; this rolled into a ball, they carry home and use in the construction of their nests. They have several queens, which dwell together in amity; live on sweet fruits, and animal substances, and are bold and rapacious robbers; nevertheless they are very tender to, and careful of their young, carrying most of their booty home to distribute to the larvæ. The wounds caused by their

stings are very painful; the best remedy against bad effects is to wash the injured part with a solution of hartshorn and water.

The *Pasteboard Wasp* (vespa chartaria) is smaller than the common wasp, dark brown, with five yellow seams on the abdomen. Found in South America, where it is much feared on account of its severe sting. Its manner of building is altogether remarkable. It makes a large nest in the form of a truncated cone, somewhat resembling a long bell, and composed of a substance like beautiful white cardboard. The interior is partitioned off into numerous passages with the same material, the several openings of which connect with the cells, which are appended to shelves, ranged along the walls.

The *Hornets* (vespa crabro), plate 26, fig. 8, mostly make their nests in holes of trees, which they enlarge by boring with their strong mandibles; are almost as large again as the wasp, which they resemble in form and color. Not quarrelsome, they seldom attack unless provoked; their sting is said to be dangerous in hot weather; and it is also asserted as a fact that horses have been killed by the assault of a troop of hornets; some, indeed, declare that nine of these insects are sufficient for effecting such a catastrophe; this, however, is not true.

Not less remarkable in manner, habits, or industry, are

The Ants (*Formica*),

Of which there are several races. Like the bees, they are divided into workers, males and females, differing, however, in one respect, namely, that instead of one female only presiding in an anthill, there are several.

Males and females, for a time, have wings; the neuters, or workers, are without these appendages. Ants do not lay up any winter stores, as they pass that season in a dormant state, but provide daily sustenance with indefatigable industry. They construct their habitation with tolerable regularity, forming cells and galleries in the interior, covering the whole with earth. Many have stings, with which they wound severely, and all have the power of spurting forth an acrid, pungent liquor, secreted by their bodies, which, lighting upon the skin, inflames it. They feed on sweet fruits, seize insects, and also prey upon dead carcasses. Considering the aphides in the relation of milch cows, they never injure their bodies, but only suck the sweet fluids that exude from them. The dwelling-place or receptacle for the eggs and larvæ is situated in the midst of the hill, the interior of which is traversed by passages leading to chambers. Most of the community are employed in carrying small bits of sticks or pine needles, etc., which they intermix with the earth that forms the principal material for their dwelling. They make regular journeys from the ant-hill to spots in the neighborhood, always performing them in companies; it has been remarked that on their going forth a regular radiated line of march is always observed. The eggs, small and milk-white, are carefully tended by the workers, who, in order to keep them damp, moisten them by licking them over with a kind of saliva; thus they increase in size, until, in due time, the grub comes forth. This new subject, in its turn, demands the care of these affectionate laborers; as soon as the sun shines warmly, the young larvæ is carried forth and fed on sweet juices, receiving this care until at length it reaches the transitionary stage, and becomes that species of pupa,

which, known as the *ant-egg*, is given as food to caged birds. Nevertheless it still remains the charge of the faithful workers; they continue to bring it forth to be warmed in the sunshine; they carry it back when cloudy to the sheltering anthill. When ready to throw off its enveloping case, they perforate it with their mandibles at one end, assist in freeing the young ant from its trammels, and, this accomplished, lead the young stranger through all the labyrinths of the dwelling.

The males and females never work; as soon as they have sufficient strength, they swarm like bees, and, forsaking the home of their nativity, fly off in hundreds to delight themselves in the air. After this swarming, the males disperse and perish; the females throw, or suffer the workers to tear, off their wings, and having arranged a new habitation, begin to lay eggs.

If closely observed during their busy movements, it will be seen that ants have a language of dumb signs, the organs of which are the antennæ with which they touch each other, whenever they meet. If a company of ants are disturbed at a distance from their dwelling, they become very uneasy; some run to the anthill, and all hasten to escape, but at the same time taking care to save the larvæ and pupæ.

If one discovers a lump of sugar, intelligence is at once communicated to the nearest neighbor, and thus passed on throughout the party; in a short time the sweet mass will be covered with a cluster of ants, although by no means lying in their accustomed path. Should their anthill be located in a place too much shaded, or in the neighborhood of enemies, they emigrate in large numbers, and as soon as a suitable spot is selected, prepare to make a new home, to which they carry the larvæ

and nymphæ. Although, for the most part, ants live in great amity and concord together, furious contests sometimes ensue, in which they kill each other; their weapons are their stings, or those who have no stings use their mandibles. With the latter they first inflict the wound and afterwards spurt the acrid fluid into it. The workers are the only warriors; males and females conceal themselves as soon as the strife begins. The fury with which they assail each other is so great that the head, separated from the trunk by the teeth of the conqueror, remains clinging to him. From two ant hills, lying near each other, and occupied by hostile parties, the way between—perhaps only one hundred feet—proceed so numerous a host that the phalanx covers a space two feet broad, where the battle rages. The combat mostly begins between two ants; these wound each other with their mandibles, and eject their venomous fluid until a third interferes, and so on until the *mêlée* is general. Towards night both parties retire, bearing their prisoners with them, leaving the dead where they fell. The ordinary operations of the two cities were not suspended whilst the battle was being fought; friend and foe were easily distinguished by these sagacious little emmets, and as those within the anthill, employed in their tasks, had nothing to eat, except what the others brought, they received the caterers with caresses, bestowed by moving their antennæ, whilst they fed on the stores thus provided.

The *Yellow Ant* never leaves its home, but in its habits resembles the aphida. Very remarkable, also, is

The *Red Amazon* or *Legionary Ant* (formica rufescens), which sally forth in the summer evenings in large troops, and attacking the nests of the negro or ash-

colored ants (formica fusca), force their way within, and steal away their larvæ and pupæ. Having a sufficient number, they make slaves of them by shifting all the domestic duties of the republic upon them, never working themselves. The amazons, a lazy race, as the others are industrious, can not live without these slaves, as, some say, they can not build their own dwellings or provide suitably for their pupæ.

The *Gall Wasps* (vespa gallicolæ—cynips) are small fly-shaped insects, which lay their eggs in the leaves or pedicles of various plants. In order to form a proper receptacle they first make an incision in the outer covering of the stem or branch, in which they deposit their eggs; the fluid thus accumulating in the wounded part, forms excrescences of a nut-shape, which, as the eggs give birth to the larvæ, increase in size. These small rudiments live on the juices of the plant, and when developed, bore small round holes into the gall, through which they escape. The form and solidity of these galls vary according to the nature of the parts of the plant where they are formed. Many are found on the oak and other forest trees, as well as on rose bushes, where the mossy covering of the excrescence gives it a handsome appearance. The well known gall apples or nuts, from which ink is made, are the excrescences found on the gall apple oak. They are best plucked before they are ripe, that is before the insect has perforated them; after this they are not fit for the dyer's use, as they are hollow and lighter-colored. The first gathered and best are called black or green gall nuts; the last collected are inferior, and known as white galls. The insects that escape from them are called

The *Gall Nut Wasps* (cynips gallæ tinctoriæ) and are

fulvous with dark feelers, upper part of the body shining brown. Found on the oaks of Lesser Asia, and used in commerce.

The *Leaf Gall Wasp* (cynips foliii), found in Europe, is black with striped neck and gray feet; lives on hazel bushes.

Cynips Petioli is black with white feet, upper part of legs brown; many other genera.

The *Rose Gall Fly* (cynips rosæ) is black, feet and abdomen dull red, pointed with black.

The *Fig Borer* (cynips psenes) is very small, brownish red with white wings, short antennæ and curved thorax. This insect perforates the fruit, not only causing it to ripen early, but also leaves an enlargement within, which, formed by the deposit of its eggs, is considered rather an advantage than an injury, as it adds a peculiar flavor to the fruit. Therefore the figs of the South, where the fig borer only is found, are said to attain a size and perfection which those of a more northern clime, however carefully cultivated, never acquire.

The *Ichneumon Wasps* resemble the fig borers, but deposit their eggs in the flesh of caterpillars or other larvæ; the little grubs feeding on the juices of these creatures, gradually consume them.

The *Black Ichneumon* (pimpla manifestator), black, with sorrel-colored feet, cylindrical body, smooth, with filiform antennæ. Length one inch, has an ovipositor an inch and a half long and very sharp, with which it bores holes in the rolled-up leaves, where other insects have deposited their larvæ, and seeking the latter, lay their eggs upon their rough bodies, and leave them to hatch in their living receptacle.

The *Black Tailed Ichneumon* (ichneumon nigrocau-

datus) is ten lines long; feet and abdomen yellow; tail and thorax black; latter spotted with yellow; selects the larvæ of the peacock's eye.

The *Yellow Ichneumon* (ophion luteus) is one inch long, with compressed body, brilliant green eyes, and short ovipositor; one yellow spot on the back.

The *Sickle Ichneumon* (fœnus jaculator) is eight lines long, black; in the middle foxy, with two silver-white spots on the head, and in flying elevate their sickle-shaped bodies above the level of their wings.

Insects of the Fly Kind (*Diptera*)

Have only two wings; are without mandibles, but instead are provided with a sucker, which, in some, have the form, and serve as a sting.

The *Horse Bat Fly* (œstrus equi) belongs to this family, and in form resembles the large *Muck Fly*, but in color a drone bee; are found everywhere in the neighborhood of horses. They lay their eggs in the inner part of the fore legs; the animal, feeling the sting, licks the spot; the nits, adhering to the tongue, are swallowed, and, changed into larvæ, fasten on the walls of the stomach, and subsist on its secretions until fully grown, and ready to assume the pupa state, when they are thrown off, and receive their winged form in the open air.

The *Gad Fly* (œstrus bovus) makes small punctures in the backs of cattle, and deposits its eggs within the wound. These soon become tumid, and, filled with purulent matter, on which these larvæ live until ready for the pupa state, when they crawl forth, and burying themselves in the ground, await their transformation.

The *Sheep Bot* (œstrus ovis) places its eggs in the

nostrils of sheep, goats, and deer, and as the larvæ develope, cause great torment to those animals.

The *Common Gnat* (culex pipiens) is four lines long, gray and annulate; wings without spots; have a long, membraneous, perpendicular proboscis, or sucker, consisting of five filaments which produce the effects of a sting. These insects develope in stagnant waters, make a buzzing noise as they fly, and prove the torment of man and beast. There are several relative species, well known in southern climates as *Musquitoes*, which are considered intolerable plagues.

The *Columbat* or *Servian Fly* (simulium reptans) is one line and a half long, with dark-brown eyes, blackish body, yellow-white below; the long legs black, ringed with white; wings transparent, and longer than the body. The trunk, provided with bristle-like lancets, is short. These insects are peculiar to Servia, within a circuit of eight or ten miles on the Danube, and at intervals appear in such fearful multitudes, as to occasion great alarm to herdsmen, as they have been known to destroy whole herds of cattle. The best protection against their stings is to anoint the bodies of the animals with salve made of tobacco or petroleum, or smoke them off by burning the leaves or stems of tobacco in their vicinity.

The *Common House Fly* (musca domestica), spread all over the world, is too well known to merit a long description; the eyes, of a brownish-red color, are remarkable, as consisting of more than four thousand facets or small eyes. The impudence of flies, intruding their unwelcome visits everywhere, has become a proverb; their increase is also incredibly great, although fourteen days are requisite for their perfect development. They

place their eggs in manure and all other decaying substances.

The *Blue Bottle* (musca vomitoria) or *Blue-flesh Fly*, is about half an inch long, hairy, black: abdomen shining blue, banded with black. The sense of smelling is uncommonly fine; discovering the presence of flesh from a great distance, they are at once attracted, and deposit their eggs upon it. Resembling it is

The *Corpse Fly;* the head is brilliant yellow, and frequently is found hovering around the corpses of human beings.

The *Gold Fly* (musca cæsar) is slender, three lines long, smooth and shining green, with gold reflections. They lay their eggs in putrid carcasses, flayed skins, etc. Are found in the open air, rather than houses.

The *Gray Meat Fly* (musca carnaria) is remarkable in bringing forth its young living, and at once fitted for preying on meat, that in consequence almost immediately afterwards becomes putrid. There are several relative species, as the *Vinegar Fly*, *Mushroom* or *Puff-ball Fly*, etc.

CLASS VII.

WORMS.—RADIATA.

Worms, occupying the lowest place in the animal kingdom, have mostly soft, cylindrical bodies, at least those which, like the common earth-worm, or leech, are designated as the true worms. In a farther division of this class, the subjects will be found to possess, instead of a soft slimy body, a more or less crustaceous or membraneous covering, serving as defense to the animals. They have been arranged in the four following orders:

FIRST ORDER: . . True Earthworms.—*Lumbrici.* .
SECOND ORDER: Intestinal Worms.
THIRD ORDER: . Sea Nettles or Star Fish.—*Polypi.*
FOURTH ORDER: Infusoria.—*Animalculæ.*

FIRST ORDER.

LUMBRICI.—TRUE EARTH WORMS.

The *Common Earth* or *Rain Worm* (lumbricus terrestris) is red and has a kind of swelling in the middle of his body, in which the gills or organs of respiration are supposed to be situated; composed of annular seg-

ments, it measures a span in length, is about the size of a quill in thickness, and has neither mandibles nor eyes. Feeds on earth, mingled with decaying substances, comes forth after midnight from holes in the ground, and is only injurious as it attacks the fine roots of plants. It passes the winter season deeply buried in the earth. Anglers use it to bait their hooks.

The *Water Worms* (gordius aquaticus) are a span long and not thicker than a violin string. Live in muddy places or standing water.

The *Leeches* (hirudo medicinalis), plate 26, fig. 11, are distinguished from other worms by the presence of small teeth and in having the posterior extremity furnished with a cup-like disk, adapted for suction. They measure a finger in length, and are about two lines in thickness; black above, with eight yellow stripes, spotted with the same color below. They live in ponds and marshy brooks; fastening on fish, they suck their blood. Their method of moving is as follows: having stretched themselves at full length upon the victim, they suck themselves fast, thus having fixed their anterior extremity, they draw the other up to it and fix that, and then readvance the first. They swim with great facility, using a serpent-like motion, and are much esteemed in medicine as useful instruments in local blood-letting. They lay eggs, which they fasten on stones or water-plants by a fibrous excretion. Those brought from Hungary are considered the best.

The *Horse Leech* (hirudo gulo) has no stripes on the back; greenish-black above, gray below. Their bite causes large pustules in the skin. Several smaller species are found in the East Indies, many of which are dangerous, as inhabiting all the muddy ditches or stag-

nant waters, through which roads pass, they fasten on the feet of barefoot travelers and suck their blood.

The *Dentalium* (dentalium entale), plate 25, fig. 7, is a worm that lives in a single shell, which bears a miniature resemblance to an elephant's tusk. It buries itself perpendicularly in the sand with the pointed end downwards, scarcely as thick as a quill, smooth and slightly red. Its length exceeds an inch. Found in all the seas in Europe.

SECOND ORDER.

INTESTINAL WORMS.

These are a numerous species, and inhabit the intestines of many animals, causing pain, disease, and often death. The most common are

The *Ascarides* (ascaris lumbricoides), which resemble the rain worms in the cylindrical form of their bodies; they are as thick as a quill, sometimes a foot long, and have the mouth furnished with three fleshy tubercles. They are common to almost every one in childhood, but in later life, except in some few cases, disappear. Santonin is considered a specific.

The *Guinea Worm* (vena medinensis) is sometimes five or six feet long, and about as thick as the largest string of a violin. Very common in hot climates, where it insinuates itself under the skin, generally of the leg, where it causes excruciating pain and severe cramps. When this is the case the skin must be opened, and the worm extracted very slowly for fear of breaking it. The

Filaria or *Thread Worm* resembles it closely; mostly found in horses.

The *Tape Worm* (tænia lata) is composed of numerous joints, is often twenty feet long, and instead of a mouth has two canals ramifying from the suckers on the head. Found in the intestines of the human species, more frequently in Russia and Switzerland than in the other European countries. Resembling it is

The *Solitary* or *Chain Worm* (tænia solium), which has the head provided with four tubes, and crowned with double hooks; with these they so completely absorb the nourishment intended for the bodies in which they dwell, that they soon exhaust them. Of all worms, they are the hardest to expel.

The *Fluke* (distoma hepaticum) is one inch long, four to six lines broad; dull yellow or brown-gray. Its form is oval, flat, with a short, bullet-shaped neck; has on the anterior portion of the body a small sucker, on the abdominal surface a larger opening. Found frequently in the gall ducts of diseased sheep and hares, but also infest those of the ox, horse, or hog.

The *Queese* (cœnurus cerebralis) resembles a bladder, in size about as large as a filbert or small hen's egg, in which are more than a hundred little white worms, varying in size from half a line to two whole ones, the heads of which have each four suckers. These worms are supposed to cause the disease called the staggers, to which sheep are subject. The animal appears to suffer great pain, and totters round and round until exhausted. The larvæ gradually consume the substance of the brain, producing death. Sometimes they infest the ox or other ruminants; very rarely horses.

The *Measle* (cysticercus cellulosæ) is barely a watery

bladder, supporting one short head, provided with four suckers. About as large as a pea, they are found in the cellular or membranous portions of hogs, and render the flesh unfit to be eaten.

THIRD ORDER.

ZOOPHYTES OR RADIATA.

This division of the animal kingdom comprehends two principal classes, namely *Polypi* and *Sea Stars* (asteria). The former have larger or smaller sized bodies, with an opening on one of the extremities, surrounded by radii or long tentacles, and live either singly or in companies. In the first case they are soft and without any encasing tegument; in the second they form a common dwelling composed of calcareous matter; this solid envelope assumes various forms, and constitutes small cells or tubes, each of which contains a polyp; the aggregated mass is called coral. The sea-stars, on the other hand, always live singly; the body is in the form of a star with five rays; the outer covering is either coricaceous or calcareous.

The *Armed Green Polypus* (hydra viridis) has a transparent cylindrical body, resembling a gelatinous tube, with from six to twelve tentaculæ on the free extremity. In length one inch, and about as thick as the tube of a crow quill; the filaments surrounding the mouth longer than the body, which they can extend or shorten at pleasure. These polyps live in fresh water ponds everywhere in Europe. Their presence is easily

discovered, although perfectly transparent, for if taken up in a bucket full of water lentils, among which they are sure to be found, and placed in a glass vessel, they always seek the side most strongly illuminated. They are really nothing more than a membraneous sack, inclosed at the lower end; nevertheless, they crawl and swim actively by agitating their long tentacles, and seize small animals, from which they suck the fluids and reject the remainder. If touched, they retract their bodies so as to resemble a small mass of green jelly, and when cut into pieces, each fragment becomes an entire and perfect hydra.

The *Noble Coral* (isis nobilis) is a stony substance in the form of a stem, with branches of a beautiful red color, and valued as an ornament; most frequently found in the Mediterranean. The little polypi are found in the gelatinous stem which forms the axis of the stony one, where, projecting their tentacles outside their cells, they resemble buds or flowers. Thus grouped, they form the coral branches, and it is often observed that the polypi on the lower portion of the trunk are dead whilst those on the upper are living.

The *Sea Feather* (pennatula rubra) looks much like the common quill, measuring six inches, and has a membraneous barrel on which these polypi rest, giving it the appearance of a bearded feather. They have been termed the gems of the sea. They fasten in the sand, and sparkle even in the daylight as if surrounded by bright little stars.

The *Sea Anemones* (actinea coriacea) are round, and resemble a flower; they attach themselves, by a broad base or foot, to a rock, and have numerous tentacula about the mouth, or upper extremity; are about the size

of a watch. The interior is hollow, and within the cavity a stomach is plainly to be seen; the foot or base is fleshy, but they can detach themselves, fix, or crawl about on the rocks, by its aid; of a brilliant red color, they look like beautiful flowers growing on the bottom of the sea. If touched, they sting like the nettle; if cut in two, each fragment reproduces a new being. They bring forth their young, which escape from the mouth, living, and are eatable; there are several species.

To the Sea-stars belong

The *Sea Hedge Hog* or *Sea Eggs* (echinus esculentus), which are about as large as an apple; have five spinous rays; in these radii are small openings from which perforations the long tentacula or membraneous feet protrude. They crawl on their mouths, searching round on the bottom for crabs, on which they feed; they are eatable.

The *Common Sea Star* (asteria rubens) is composed of five rays; star shaped, with small rugged knobs on the back, and measures a span in diameter.

The *Medusa* (euryale caput Medusæ). The border rays divide themselves into branches capable of contraction or dilatation. The body, a span in length, is broad, more or less convex, resembles the cap or umbrella of a mushroom; red, like coral; rough and knobbed like that of a shark. It lives in the Arctic seas, and may be seen swimming, which motion is performed by the contraction or dilatation of the tentacula, which form the margin of the umbrella, and probably serves it to seize the small mollusca on which it feeds.

The *Indian Medusa* (asterias euryale), also called the *Gorgon's Head.* The disk is divided into five ragged branches about the length of a hand; each of

these are again subdivided, until they become thin as threads. These branches consist of innumerable osseous segments or plates. The color is generally red, sometimes, however, it is found gray, green, yellow, or black. Seen under water, it resembles an expanded flower, but when but slightly raised in the water, the serrated rays hang down like flaps; but if drawn forth entirely it fastens from above on the hand, which not a little alarms the intruder, who, believing only to have grasped a mass of inert matter, finds it a living creature, and disposed to resent. It dies immediately. Contracting all its radii into a globose form, it folds itself up like a plant that closes its petals at night. It can not be kept, even with the greatest care, but a very short time, as it is exceedingly brittle, and the joints very slightly connected.

FOURTH ORDER.

INFUSORIA.

The infusory animals or animalculæ, found in all waters more or less corrupted, are so minute that few of them can be seen with the naked eye. But, notwithstanding their extreme smallness, the microscope has enabled the naturalist to discover the form and trace the organization of these creatures, which form the last series of beings in the animal scale. Professor Ehrenberg has been successful in discovering their existence, as well as organization, in the infusions of different plants, such as carmine, blue, etc., which, used for dying, contained animalculæ. These Infusioria, receiving the colored fluid,

which they sucked into their transparent bodies, its course could be distinctly traced in the internal processes of a stomach and intestinal canal. Although so exceedingly minute, they differ greatly in form. Some are round; others flat or oval, cylindrical, shorter, or longer. The bodies are mostly smooth; some, however, have a gall-like covering; others a calcareous coat of mail, which is of different forms—either shell, shield, or mantle-shaped. They all have, on the fore part, a very singular prolongation, which is considered the organ of locomotion. Below this are the tail and the wheel-like apparatus by which they perform the rotatory vibrations from which one class receive their name (Rotifera). This consists of various tubes, fitted into each other, like those of a telescope; or else of numerous soft syphons in the vicinity of the mouth, and surrounded with rows of cilia. Many species have the faculty of prolonging the body in front, and thus change its form; others are clothed with stiff hairs, or beards, and have horns, spurs, suckers, and muzzles. The vibratile cilia is, however, with a somewhat different arrangement, found in most. These, placed around the mouth, or often over the whole body, are always in motion, and in water revolve in circles, serving also as antennæ. Some are dotted with red and black points; others have eyes placed just above the mouth; no others of the organs of the senses can be observed.

The Infusoria abound in great numbers, and spring into existence either by the simple, but ever active power of creative nature, or else issue from eggs which they produce in great numbers. Those which have a calcareous or fossil-like envelope, form, after dying, large hills. This might seem incredible, that such minute creatures could thus subserve so great a purpose, had it not been

proved, by late discoveries, that many formations of rock owe their origin to the Infusoria. For instance, chalk cliffs are supposed to have arisen from a combination of the calcareous scales or shells of the animalculæ, belonging to the antediluvian world. This class feed not only on all corrupt substances, but also seize and devour each other. Space can not be afforded for a general review of the species. We will, however, mention a few.

The *Smallest Point* (monas termo) a thousandth part of a line (tenth of an inch) long, and, a mere point, is a simple globule, without tail or eyes; nevertheless, it swims about rapidly by means of its mouth. A single drop of water is said to contain five thousand millions.

The *Globe* (volvox globator), being about the third of a line in size, can be seen by the naked eye. It is transparent, studded with more minute globes of green. If viewed under a microscope, these minute creatures can be seen revolving with great rapidity on their own axis.

The *Wheel Animalcule* (virdicella senta) is one-sixth of a line long; almost globular; as it moves emits a phosphorescent luster.

The *Vinegar Eel* (vibrio asceti) is hardly a line in length, and has a thread-like body; found in great numbers in vinegar, so that many thousands are swallowed in taking a spoonful of this fluid. Are never found in bad vinegar.

THE VEGETABLE KINGDOM.

PLANTS, like animals, are living, organized matter, but, although possessing vital action, they are distinguished from the latter in that they are incapable of locomotion; for, whilst most animals possess the power of moving from place to place, the plant strikes its root firmly into the ground, and only turns towards the point from which it receives light or nourishment. Therefore, as the whole body stands firmly rooted, it may be concluded that this inclination or movement must be gradual, and affected only by certain portions of the plant. The root, for instance, inclines naturally towards the spot from which most nourishment can be derived; the leaves turn to meet the light; and whilst the more highly organized animal can never derive subsistence from unorganized matter, vegetables, on the other hand, are, from the power they possess of absorption and assimilation, fully able to derive their nourishment from inorganic substances; these are absorbed from without, and are oxygen, hydrogen, azote or nitrogen, and carbonic acid gas. As it is important to know in what manner these elements are made essential to the nutriment of plants, we will try to explain it

It must not be supposed that the vegetable derives its

nutrition solely from the earth which forms the basis and furnishes facilities for the firm planting and outspreading of its roots; this is the office assigned to it by nature, but nothing more. The manner in which the nutritive matter is received by the plant is as follows: Hydrogen and oxygen are received through the water, which is indispensably necessary to maintain its vitality, and, either in the form of rain or vapor, penetrates the earth; in this a quantity of carbonic acid gas is dissolved, which the plant absorbs. Nitrogen is received partly by the atmospheric air, which is a compound of oxygen, nitrogen, and watery vapor, and partly that, during a thunder-storm, much nitric acid is found in the water, which, always holding in solution a greater or less quantity, finds its way to the roots of the plants. In the meantime few plants, subsisting barely on inorganic matter, attain to full, luxuriant growth, but require, in order to a more perfect development, the presence of organic matter, which, in combination with the elementary substances above named, tends to the promotion and improvement of the vegetable classes. This organized matter, well known as manure or compost, is formed of decayed animal or vegetable substances; and as these decompositions serve for a healthy nourishment to plants, we must infer that the subjects of the vegetable kingdom possess the faculty to perform the important work of purifying the atmosphere of such impure gases as would prove deleterious to man and beast. It is well known how soon the air of a room in which men or animals are confined becomes impure; and, remaining unventilated, causes death. This is because the oxygen inhaled with the atmospheric air is exhausted, and the carbonic acid thrown off in breathing poisons the air, soon making respiration

impossible. Plants, on the contrary, have the faculty of inhaling carbon and exhaling oxygen, retaining the former as necessary to their vegetable existence; so that we may not suppose that plants are only useful, as they please with their variety and beauty, or form a portion of the nutriment of the animal kingdom, but by the purifying influence they exert on the atmosphere, are absolutely necessary for the continuance and comfort of animal life. Experience, too, has shown how important is their agency as articles of food; most animals live altogether on vegetables, comparatively few are so carnivorous as wholly to reject them; and it is a well known fact that all places destitute of vegetable life are not only uninhabitable, but also very unhealthy.

Vegetation is, therefore, the precursor of animal life in the economy of nature; all animals, either directly or indirectly are nourished by plants; and the vegetable kingdom thus rendering such varied and important service to the animal, may be truly said to touch closely on its foundation. There is scarcely a plant that does not nourish some animal; almost all insects, for example, live either in the perfect or in the larva state at the expense of the plant upon which they are habitually found; even in the highest classes of animals the number of vegetable-eating species is immense; and man, standing at the head of the mighty chain of being, also derives most of his food from the vegetable kingdom.

Plants themselves, however, unlike animals, subsist on barely inorganic matter; they do not, like them, require a digestive apparatus by which the aliment necessary to their existence is extracted from the rude mass, but absorbs the nutritive portion through the roots. The fluid, thus introduced into the body of the plant, and

called sap, rises into the stem; from thence it is carried into the leaves, which are the special organs of exhalation and respiration, and it is through their agency that the superfluous oxygen is thrown off. The roots, therefore, performing the digestive process of extracting nutrition, have been considered as the stomach of the plant, the stem its body, and the leaves its lungs.

All plants, however, are not rooted in the earth; there are many which float on the water, sending their filamentous roots below the surface; some, the lichens, for instance, spreading themselves over the naked rock, seem to derive no aid from the earth, and others, like the mistletoe, and the family of parasites, springing from other trees, obtain from them the living principle.

The multiplication of plants takes place, most commonly, through the seeds which are formed in the flower; sometimes by means of special organs destined to produce the germ of a new individual; and sometimes by the simple division of their tissue, or driving their roots through the earth, shoot up at a distance from the mother plant, and maintain an independent growth. The common strawberry, as is well known, sends out its runners, and forces its way over every obstacle, until a favorable spot is found for putting forth a bud; this being effected, the thread-like roots fix themselves firmly in the ground, and a new progeny is formed. Every part of a plant, at least from those of the most perfect development, is capable of sending forth new roots; branches turned downward, and covered with earth, take root, and reproduce a new growth of the same species; the same is also true of roots, which have the faculty to give rise to leaves and stems.

Plants are distinguished as simple or compound. In

the first named we find a like connection and symmetry as in the higher class of animals; one plant is an independent individual, as, for instance, the grasses, palm tree, or onion-like bulbs. In these families, propagation by buds or shoots is not to be thought of; their reproduction is effected by seed, tubers, or offsets from the roots. It is, however, different in the compound species, where many individuals are found on one stem. The leaf buds and twigs of the apple may be considered each as a separate member, and, if surrounded by moist earth or moss at a particular point, will put forth roots without a stagnation of the nutritive juices being necessary. When these roots appear the branch may be cut, and so separated from the parent plant, becomes a new individual. If a healthy branch or bud is carefully cut and placed in an incision made between the bark and wood of a tree belonging to the same species, it grows as readily as on the parent plant, and is called *grafting* or *budding*. These two examples serve to show that plants, capable of propagation, are not simple or individual subjects of the vegetable world, but one tree is a sort of community of members, of which, like the coralline polyps, many subsist on one stem. In the economy of simple plants a different arrangement is observed between their nutritive organs and those of the compound. The palm, bulbs, and grasses come forth from the earth almost with nearly the same thickness they ever attain. They increase only in height, scarcely any in circumference. The interior of the stems of these plants, when not altogether hollow, is filled with a round cellular tissue, the fine vessels of which ramify in all directions. In these classes, the stems, if closely observed, present no distinction between wood and bark; in the compound

plants, however, this difference is fairly manifested. First appears a slender, succulent stem, which soon divides into two principal parts, outer and inner; the outer rind or cortical portion is called bark, the inner or ligneous, is termed wood; both, although at first soft, gradually dry and become hard, after which they serve for the support and protection of the plant, rather than for its nourishment. The portion in which are placed the organs of nutrition lies between the bark and wood; it remains unchanged and soft during the life of the plant, and is called *alburnum* or *sapwood*. This drying up every year adds alike to the thickness of the bark and wood, and thus, as layer after layer is formed annually, the plant increases in circumference, and on being sawed across will be found to consist of a number of rings, by which its age is determined. Not so, however, with the bark, for, although a new layer is annually added, instead of forming ligneous layers like the alburnum, after having once served the purpose of circulation, it is thrown aside, or rather divides, as the girth of the plant increases, into rifts or fissures, as if forced to do so by the accumulating growth within.

The most important part of a plant, however, is its flowers, for not only do they bestow pleasure from their brilliant colorings, beautiful structure, and sweet odor, but are also most useful as being the precursors of the fruit. And besides these, it is the flowers that bear the seed which is to perpetuate the race, and are the characteristic tokens of the species to which they belong.

Whilst animals are always found divided into the two races of male and female, in the vegetable world the sexes are frequently found united in one flower, and the organs peculiar to each are plainly observable. In a tulip, for

instance, the organs of multiplication are very evident, as they are in nearly all the phænogamous or flowering plants. The pistil occupies the middle of the corolla, at the termination of the axis. It consists of three parts: the ovary, or germ, the style, and the stigma, and around it are six stamens. Above these are little round bodies or sacs, containing a fine dust, which is the fructifying pollen. Thus, from their peculiar structure, the flowers belonging to this class, termed polygamia or unisexual, contain the procreative principle within themselves; and even as this is the case in all the Lilyaceæ, so there are others, like the hemp, in which some plants only are the seed-bearers, or in the pine, on which are found blossoms evidently different as to sex. Many plants, however, are so small that the sexual characteristics can not be determined.

If the movement of the sap in a plant is in any way interrupted, the parts immediately begin to wither and decay, and it soon dies altogether. Many last only one year, and, dying as soon as their seed is matured, are called annuals; others require two years before they attain their ultimate perfection: these are termed biennials; and again, there are some, which, existing for an indefinite number of years, are known as perennials.

Linnæus, whose system is considered the most simple, distributed the plants into classes according to the number, size, growth, or peculiar functions of the stamens or male organs. These are as follows:*

* Some naturalists have based the arrangement on the texture and size of plants, classing them in divisions of *Herbs*, *Shrubs*, and *Trees*. Others, again, on the structure and form of the *Calyx*, the *Corolla*, the *Fruit*, etc, or on the presence or absence of some important organ: the favorite object, at present, following Jussieu and De Candolle, is to arrange plants strictly according to their *affinities;* to group to-

A—Flowering plants, or those with visible flowers.

a—Hermaphroditæ, or those which unite both sexes in the same flower.

1. The stamens are free and of indefinite lengths.

Class 1. Monandria—one stamen—Shavegrass.
" 2. Diandria, or with two stamens—Privet.
" 3. Triandria—with three stamens, as the Corn or Sword Lily.
" 4. Tetrandria—four stamens, as the Lady's Bedstraw.
" 5. Pentandria—five stamens—Primrose, Anemone.
" 6. Hexandria—six stamens—Leek, Tulip.
" 7. Heptandria—seven stamens—Horse Chestnut.

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gether, in *Orders* and *Tribes*, those which are most nearly related in *all* the features and properties which constitute *character*. "These various systems may be all regarded as forming only *two* kinds, namely, the *artificial* and *natural methods*, though in point of fact, the *artificial* methods are more or less founded on *nature*, and in the most perfect *natural* arrangements yet devised, *artificial sections*, or groupings, are still resorted to as useful helps and expedients. What is called a natural method, is so termed because it expresses the natural relationship of plants as far as practicable; for every form yet devised, or likely to be contrived, is, to a considerable extent, artificial." The *Linnæan Classification*, founded on the characters of two of their most important organs—namely, the *stamens* and the pistils—has the merit of combining some of the advantages of both the artificial and natural methods, and will probably long continue to be employed as a convenient and useful help to the investigations of young beginners. It is remarkable how many natural families of plants are kept nearly entire, under the *Sexual System*.

It has been often objected to the Linnæan method, that there are too many exceptions to the rules of classification—that a number of *genera* comprise *species* which, according to the system, belong to a different *Class* or *Order*—and thus mislead and puzzle the student. This objection is undoubtedly founded on fact; nevertheless, to those who are commencing the study of Botany—and especially to such as have no other aid than books—I would say, avail yourselves of the Linnæan method as the easiest stepping stone to the vestibule of the temple, and the readiest means of acquiring the names and learning some of the characteristics of the more common plants by which the student is surrounded.—Darlington's Flora Cestrica.—*Tr.*

Class 8. Octandria—eight stamens—Bibbery, etc.
" 9. Eneandria—nine stamens—Laurel.
" 10. Decandria—ten stamens—Gilliflower, Rue.
" 11. Dodecandria—with from twelve to nineteen stamens—Mignionette.
" 12. Icosandria—twenty or more stamens, inserted on the calyx—Apple, Rose.
" 13. Polyandria—stamens twenty and upwards, inserted on the receptacle—Poppy, Linden.

These orders are characterized by the number of the pistils. Also by one, two, or more stigmas.

2. The stamens free and of unequal lengths.

Class 14. Didynamia—four stamens, two longer than the others—Lion's Mouth, and distinguished by having the seed free or covered.
" 15. Tetradynamia—six stamens, four longer than the others—Cress, Stock, Gilliflower, etc.

This order is determined by the size of the seed-pod.

3. The stamens adherent to each other in one fascicle.

a—Adherent with one another, or to the pistil, in two fascicles.

Class 16. Monadelphia—filaments united—Mallow.
" 17. Diadelphia—stamens divided into two bundles—Butterfly Weed, or Aselipias.
" 18. Polydelphia—several bundles of stamens adherent—St. John's-wort.

These orders were arranged according to the number of their stamens.

a—Anthers adherent; stamens free.

Class 19. Syngenesia—five stamens, united by their anthers; flowers collected into a common involucre or envelope—Lettuce, Thistle.

This class is determined in proportion to its fertility.

c—The stamens united to the pistil.

CLASS 20. GYNANDRIA—has six stamens, forming a single body with the pistil—Arum, Calla.

b—Separate races.

CLASS 21. MONŒCIA—Male and female flowers on the same stem—Indian Corn, Pink.

" 22. DIOECA—male and female flowers on two different individual plants—Wood, Hemp.

" 23. POLYGAMIA—sometimes male, and at others, female or hermaphrodite flowers, on one, two, or three individual plants. To these belong the Maple, Ash, and Fig.

These orders are regulated according to the number and relative adhesions of their stamens.

B—Unprovided with flowers, or else the bloom is so small as not to be discernible.

CLASS 24. CRYPTOGAMIA—Fern, Moss, Lichens, Mushrooms.

This arrangement into classes by Linnæus* has the one great advantage, namely, that every plant by it may be recognized in its proper place. Nevertheless, there are some disadvantages; for instance, the accidental separation of the stamens or anthers from each other may cause some confusion in certain genera. This method, although simple and elegant, is avowedly *artificial*, and therefore we present to our readers the natural distribution of the families of plants by De Candolle, still retaining the classification of Linnæus. In order to avoid

* "The sexual system of Linnæus lays no claim to the merit of being a natural arrangement. Its sole aim is to assist in determining any described plant by analytical examination, and nothing can be more simple than the first eleven, as the stamens need only to be counted in order to distinguish them.—CYCLO. AM.

repetition, we substitute signs for words, and thus secure brevity.*

⊙ Annual Plants.
♂ Biennial Plants.
♃ Perennial Plants.
♄ Shrubs or Trees.

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* Botanists have successively employed different artificial systems and natural methods in the classification of plants. We therefore introduce to the notice of our readers three synoptic tables, as arranged by the three celebrated naturalists, namely, Linnæus, De Candolles, and Jussieu. Linnæus's method has been already mentioned. The learned and sagacious Jussieu, who first elaborated and published a natural system, in 1798, arranged the vegetable kingdom in fifteen classes and one hundred orders or families. Endlicher, in 1840, gives no less than sixty-one classes, and two hundred and seventy-seven orders, with tribes and sub-tribes almost innumerable.

In an exposition of the natural system, some authors (Jussieu and Endlicher) commence with the lower extremity of the series, and end with the higher; others, as Candolle, pursue the opposite, beginning with the most perfect flowering plants, and concluding with the lowest grade of flowering plants. The first mode possesses the advantage of ascending by successive steps from the simplest to the most complex structure; the second, that of passing from the most complete and best understood to the most reduced and least known forms; or, in other words, from the easiest to the most difficult, and is, therefore, the best plan for the student.—Prof. Gray.—*Tr.*

TABLE ACCORDING TO THE SYSTEM OF LINNÆUS.

- Having visible flowers, existing together in the same flower
  - stamens not adherent to each other
    - stamens of same length
      - less than 20 stamens
        - 1 stamen — MONANDRIA.
        - 2 stamens — DIANDRIA.
        - 3 " — TRIANDRIA.
        - 4 " — TETRANDRIA.
        - 5 " — PENTANDRIA.
        - 6 " — HEXANDRIA.
        - 7 " — HEPTANDRIA.
        - 8 " — OCTANDRIA.
        - 9 " — ENNEANDRIA.
        - 10 " — DECANDRIA.
        - 11 " — DODECANDRIA.
      - 20 stamens or more
        - adherent to calyx — ICOSANDRIA.
        - adherent to receptacle. — POLYANDRIA.
    - stamens differing in length
      - 4 stamens, 2 of which are longer — DIDYNAMIA.
      - 6 stamens, of which 4 are longer — TETRADYNAMIA.
  - stamens adherent to each other, or to the pistil
    - stamens not adherent to the pistil, but adherent to each other
      - by the filaments
        - in 1 fasciculus — MONODELPHIA.
        - in 2 fasciculi — DIADELPHIA.
        - in more than 2 — POLYDELPHIA.
      - by the anthers — SYNGENESIA.
    - stamens forming a single body with the pistil — GYNANDRIA.
- Essential organs of these flowers, that is, the pistils and the stamens, separate and placed in distinct flowers
  - male and female flowers on the same individual plant — MONŒCIA.
  - male and female flowers on two individual plants — DIŒCIA.
  - sometimes male, and at others female, or hermaphrodite flowers, on 1, 2, 3 individual plants — POLYGAMIA.
- Unprovided with flowers — CRYPTOGAMIA.

TABLE OF THE NATURAL SYSTEM OF DE CANDOLLES.

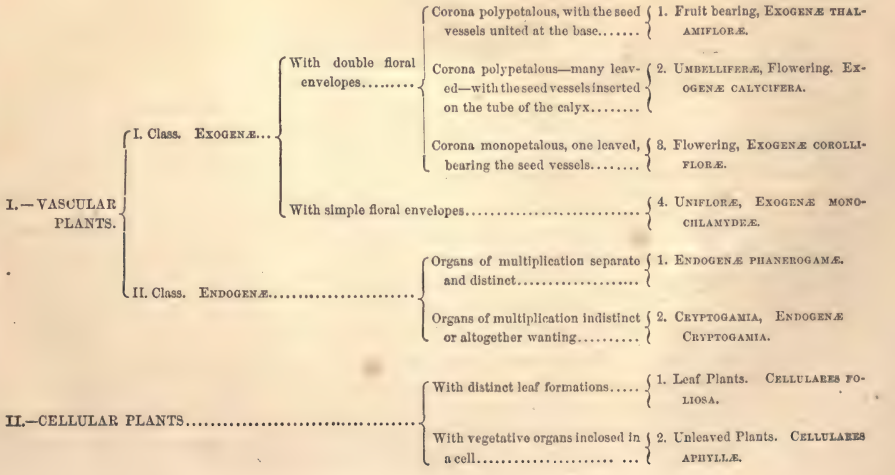
I.—VASCULAR PLANTS.
I. Class. EXOGENÆ...
With double floral envelopes.....
Corona polypetalous, with the seed vessels united at the base.....
1. Fruit bearing, EXOGENÆ THALAMIFLORÆ.
Corona polypetalous—many leaved—with the seed vessels inserted on the tube of the calyx.....
2. UMBELLIFERÆ, Flowering. EXOGENÆ CALYCIFERA.
Corona monopetalous, one leaved, bearing the seed vessels.....
3. Flowering, EXOGENÆ COROLLIFLORÆ.
With simple floral envelopes.....
4. UNIFLORÆ, EXOGENÆ MONOCHLAMYDEÆ.
II. Class. ENDOGENÆ.....
Organs of multiplication separate and distinct.....
1. ENDOGENÆ PHANEROGAMÆ.
Organs of multiplication indistinct or altogether wanting.....
2. CRYPTOGAMIA, ENDOGENÆ CRYPTOGAMIA.
II.—CELLULAR PLANTS.....
With distinct leaf formations.....
1. Leaf Plants. CELLULARES FOLIOSA.
With vegetative organs inclosed in a cell.....
2. Unleaved Plants. CELLULARES APHYLLÆ.

TABLE OF CLASSIFICATION OF PLANTS ACCORDING TO JUSSIEU.

CRYPTOGAMIA or Inembryonate—Acotyledons..... { Cellulares.. { Algæ. Fungi. Lichenes. Hepaticæ. Characeæ.
Semi-vasculi { Equisetaceæ. Filices. Aquatic plants. }
Aphyllæ.

EMBRYONATE OR PHANEROGAMOUS COTYLEDONS

Monocotyledons. { stamens hypogynous, fixed below the ovary..... Monopetalæ. { Asparagi. Palmæ. Asphodeleæ. Liliaceæ.
stamens perigynous, fixed on the calyx around the ovary. Monopetalæ. { Bromeliæ. Scitamineæ. Orchideæ.
stamens epigynous, fixed on the upper part of the ovary Aristolochieæ.

Dicotyledons.... { without petals.. { stamens epigynous..... Euphorbiæ. Urticæ. Amaranthaceæ, &c.
stamens perigynous..... Piperitæ.
stamens hypogynous..... Hydrophyllæ.
polypetalous.. { monopetalous.. { corolla hypogynous..... Hypocorolleæ. Labiatæ. Convolvulaceæ. Solaneæ. Lentibulariæ, &c.
corolla perigynous..... Pericorolleæ. Synanthereæ. Corymbiferæ. Cichoraceæ.
flowers hermaphrodite or monoecious..... { corolla epigynous. { Epicorolleæ. { anthers cohering Cohesantheræ. { anthers distinct Oleineæ.
stamens epigynous..... Epipetaleæ. Umbelliferæ. Araliaceæ.
stamens hypogynous..... Hypopetaleæ. { Malvaceæ. Tiliaceæ. Papaveraceæ. Cruciferæ. Caryophylleæ. Amygdaleæ. Rosaceæ. Myrtaceæ. Cucurbitaceæ. Ficoideæ. Ranunculaceæ. Tribulaceæ. Terebinthaceæ. Rhamneæ. Cistineæ. Ericineæ.
stamens perigynous..... Peripetaleæ. { Myrtaceæ. Rosaceæ. Jussieuaceæ. Onagraceæ. Grossulariæ. Cucurbitaceæ.
flowers unisexual, borne on two individuals..... Diclineæ..... { Coniferæ. Cycadeæ.

FIRST DIVISION.

VASCULAR PLANTS.

These plants are provided with vessels and cellular tissue. The germ is enveloped in one or more layers.

CLASS I.

EXOGENÆ.

The vascular organs, sap-wood, or alburnum, are composed of one or more concentric rings or layers, the youngest of which is always next the external covering. Envelopes of germ in a whorl.

A.—Provided with double flower-envelopes, that is, consisting of both calyx and corolla; petals separate from each other.

SUB-CLASS I.

Seed bearing. Flower polypetalous; the petals inserted on the calyx.

FIRST DIVISION.

Many fruit ovules contained in one flower, or with the anthers [illegible] edge of the flower.

RANUNCULUS FAMILY.—RANUNCULÆ have mostly weak and flexible stems, often climbers or creepers, are warmly aromatic plants, containing a juice which acts as an acrid narcotic poison.

The *Common Buttercup* (Ranunculus acris) is found abundantly in meadows; leaves notched, flowers brilliant

gold color, giving the fields a gay appearance; blooms in May or June; many call it buttercup. As it is very acrid, it is bad food for cattle, and as a troublesome weed, very detrimental to the meadows. By boiling, it loses its acrid property. The garden ranunculus is considered quite ornamental, but there are many wild plants belonging to this species, which are very poisonous. 2f. Class 13, Linn.

Tall *Crow Foot* (Ranunculus ficarius). Leaves heart-shaped, lanciniate, somewhat fleshy; roots tuberculated; flowers yellow, with from eight to ten petals. Found in spring; very common in woods. Leaves and tubers eatable; the last, when washed out by the rain, has a sweet taste, and obtained for itself the very popular name of *Rain Manna.*

The *Wood Anemone* or *Wind Flower* (Anemone nemorosa), Linn. Leaves tripartite with lancet-shaped, acuminate tips; flowers whitish. Found everywhere in woods in March and April; is acrid and often injurious to cattle grazing where it grows. 2f. A species considered ornamental is cultivated in gardens.

Virgin's Bower (Clematis vitalba), Linn. Leaves tailed, feathered, and deeply notched; the stalk flexible and climbing. Frequent in moist woodlands and thickets, clinging to supports by its petiolate leaves; the flowers white and umbelliferous.

The *Pæony* (Pæonia officinalis). Corolla full-leaved; petals leaf-shaped, numbering from five to ten; flat, red mostly, but sometimes sprinkled with white, and from two to five germ buds. Leaves feathered; fruit-pods felt-like. This handsome plant grows wild on the rocky hills of southern Europe, but is cultivated in gardens for sake of its beauty. Blooming in May or June, the

root, although acrid and poisonous, is used in medicine.* ♃.

Devil in a Bush—Love in Mist (Nigella damascena) has a smooth branching stem; flowers covered with a kind of veil; seed enclosed in five separate capsules. Grows wild in the south of France and Italy; cultivated farther north in gardens; flowers are white, blue, and greenish; blooms in June and August. ☉. Sometimes called *Ragged Lady*.

The *Lark Spur* (Delphinum ajacis), calyx petaloid,† corolla‡ undeveloped, upper sepal or leaflet produced into a spur at base. Flower petals four, the two upper with a spur-shaped appendage at base, enclosed in the spur of the calyx. Buds blue and grape-like; stem grows to a height of three feet; is found single, but the petals are often multiplied into double flowers. ☉ and ♂.

Second Family.—Magnoliaceæ, to which belongs

The *Tulip Tree* (Liriodendron tulipifera), a large and beautiful tree, growing to a great thickness. Sepals§ three, caducous‖ corolla campanulate; petals mostly six, yellow and green, at base red. Blooms in July, and is the ornament of a garden as well as of the forest. ♄. Class 13, Linn.

The *Stellated Anise* (Illicium anisatum) grows in China, Japan, and the Philippines; somewhat like a

* The physician Pæon, according to mythology, first used this plant in medicine, and cured Pluto with it.—*Tr.*

† Petal-like.

‡ Corolla, the delicate inner covering of the flower between calyx and stamens.

§ Leaflets of calyx—sepal—distinct portion of calyx; sepaloid green and not petal-like.

‖ Caducous—falling off readily. Corolla-flower—campanulate—bell or tulip-shaped.

cherry tree; the leaves resemble those of the rose bay, but are softer. The blossoms or flowers are much like those of the narcissus; are composed of thirty yellow petals, twenty short stamens, and eight pistils. The fruit is the well known anise.

THIRD FAMILY.—MENISPERMACEÆ.—The *Common Moonseed* (Menispermum cocculus). Stem shrub-like, climbing and fastening by tendrils; branching out profusely; leaves peltate, heart-shaped, emarginate, smooth, dark green above, blue-green and downy below; length from eight to twelve inches. The flowers hang in long clusters like grapes, measuring from one to two feet in length. The fruit is reddish-purple, with a soft, fleshy envelope, and brown kidney-shaped seed. Found in the Indian Archipelago, in the neighborhood of the sea-coast. The species known as Cocculus Indicus, coming to us in a dried state, has an oily and intensely bitter kernel, which contains an acrid narcotic poison. These kernels are used in India as bait for taking fish, but it is a very improper method, as the eating of fish, thus caught, has proved very injurious; being productive of stupor to the scaly tribe, they are more easily taken by this bait than any other. Cocculus Indicus, it is said, is used in England in the manufacture of porter. Sometimes called *Fishing Berries*.

FOURTH FAMILY.—BARBERIDACEÆ,—*Common Barberry* or *Sour Thorn* (Berberis vulgaris) is a shrub growing to a height of nine feet; leaves ovate and serrate; calyx consists of six sepals; flowers yellow, with six petals; grow in drooping racemes;* the stamens, if

* Raceme—a mode of flowering by which the common peduncle (foot-stalk or flower-stem) is elongated with the flowers on short, lateral, simple pedicles.—*Tr.*

touched by a needle, instantly draw up or contract. Blooms in May or June; bears a scarlet berry in September, is juicy and acid, but very pleasant to the taste. This juice pressed, strained, and boiled with sugar, makes a refreshing syrup. The fine yellow wood is used for inlaying; the bark of the root furnishes a yellow dye. It grows spontaneously in the hedges almost everywhere in Europe. 2ℓ. Class 6, Linn.

Second Division.

Fruit mostly of a one-celled pod or capsule; stigmas persistent or permanent.

Fifth Family.—Papaveraceæ,—Class 13, L. The *Common Poppy* (Papaver somniferum). The calyx is composed of two sepals and drooping; corolla of four petals, when cultivated has many more. The seed pod is as large as a moderate-sized apple, and divided into incomplete partitions, upon which is a sessile cicatrice, radiating from the summit. Stalk upright; leaves smooth, fleshy, and blue-green. The Poppy is originally from the East, and on account of the oily juice contained in its fine white albuminous seed, is cultivated in Europe and elsewhere. There are some species in which the seed is black. If an incision is made into the unripe capsule a milky juice is seen to flow, which, on being dried, turns brown, is well known as opium, and acts as a narcotic poison. ☉.

The *Corn Poppy* (Papaver rhœas), Endl. German, *Klatschrose*, is branching and bristly; leaves divided;* flowers bright red, and most frequently found growing among grain. The capsule is about as large as a hazel-

* Pinnately dissected.—*Tr.*

nut. The petals are used in infusion as a narcotic or rather anodyne. ☉.

The *Celandine* (Chelidonium majus). Leaves are pinnate, and divided into feathery lobes; calyx has two sepals; carolla four petals; flowers yellow and hang in umbels; blooms from May to September. Found everywhere by walls and hedgerows; yields a deep yellow juice, the course of which, if the plant be viewed with a magnifying-glass, can be distinctly seen as it circulates through stem and leaf. After flowering, it bears a pod in which is the seed.

SIXTH FAMILY.—FUMATORIA.—Class 17, Linn.

The *Common Fumatory* (Fumaria officinalis) is a small branching, climbing plant, with leaves dissected and many cleft; flowers beautiful flesh color, blooming in clusters. It has a bitter flavor, but is considered good fodder for sheep. ☉.

Corydalis (Corydalis solida). Calyx has mostly two sepals, sometimes altogether wanting. Only one of the four petals—the upper posterior one—is spurred. The middle anther of every fascicle, or little bundle, are double, the others single; fruit pod like that of the poppy, but not separated into compartments, many seeded and bivalved. Grows among hedgerows.

SEVENTH FAMILY.—CRUCIFERÆ.—Class 15, Linn.

The *Water Cress* (Nasturtium officinale) has a diffuse, hollow stem, spreading root-like along the ground. The leaves are heart-shaped, flowers white, and the pods cylindrical. The leaves are very juicy, have a pungent bitter taste, nevertheless they afford a palatable and healthful article of food, and are used as salad. Grows in ditches and brooks, and blooms in June and August. ♄.

The *Common Meadow Cress* or *Cuckoo Flower* (Cardamine pratensis), L., has pinnate, feathery leaves, and reddish-white flowers; bears seed pods an inch long. Found everywhere in meadows. ☉.

The *Gilliflower* (Cheiranthus annuus) has a shrub-like or ligneous stem; leaves lanceolate and indented; grows a foot high; flowers red and white, sometimes single, at others double; often cultivated in gardens. ♂. There is a species greatly resembling this, called the *Winter Gilliflower*.

The *Black Mustard* (Sinapis nigra), Tournef. The leaves are attached to the stem by foot-stalks four inches long and two broad; the flowers yellow. The pod measures about an inch, and contains from four to six brown seeds. Grows in fields and waste places; blooms in July and August; is frequently cultivated. The seed is valued on account of its pungent aromatic taste, and mixed with vinegar, etc., is used as a condiment with beef. It is also valuable for its vesicating properties, and much used for foot-baths and blisters; is of as much importance to the physician as the cook. Resembling this but weaker, is the *White Mustard;* the seeds of both, by being pressed, may be made to yield a mild oil, used also for vesication. ☉.

The *Cabbage* (Brassica oleracea), De Cand., has fleshy leaves; flowers of pale yellow; the stalk from three to four feet high; branching; pods from two to three inches long; the seed very dark brown. Cabbage was originally brought from Greece, where it still grows wild, and has produced many valuable species, which are now cultivated in gardens.

The *White Cabbage*, of which the leaves are mostly white, but sometimes red or blue, and very broad, readily

form themselves into a head. The white cabbage is one of the most important vegetables in use among the German population. As soon as the heads are properly closed, which is early in the autumn, it is made, with the addition of salt, etc., into the well known Sauerkraut.* The species most preferred for this purpose is the sugar-loaf cabbage, and is raised in great perfection in the fields of Wurtemberg. ♂.

Another species of cabbage, much esteemed, is the *White* and *Green Curled Savoy*, the leaves of which are yellow and curled. Another of the tribe is the *Winter Cabbage*, with dark green, crisped leaves; both are excellent vegetables. The cauliflower, which was originally brought from Italy, is much esteemed; it differs from the other species in bearing, in strong tufts, a number of whitish-yellow, well-tasted flowers or buds, which, from their resemblance to a cheese curd, are often called cheese cabbages. ♂.

Broccoli has the same kind of a head as the cauliflower, but smaller; is of different colors, as white, blue, and darkish. If the head is cut off, the stem puts forth a shoot which tastes like asparagus; sometimes called asparagoides. ♂.

Caula Rapa—Bulb-stalked Cabbage. This species is distinguished by sub-globose or apple-formed fleshy enlargements on the stem at the origin of the leaves, which, together with the latter, are used as table diet. ⊙.

Turnip-rooted Cabbage (German, *Boden Kohlrabe*), is distinguished from the former in having the fleshy

* Also what is commonly termed Cold-slaw, which is a corruption of *Kohl-salat* (German), cabbage-salad.

bulbs under the earth. These roots are in common use, and known as the *White Turnip.* ⊙.

The *Common Turnip* (Brassica rapa) differs from cabbage by the bright green color of the rough radical leaves, while those of the stem are blue-green, and smooth. The principal specimens of this genus are the common white turnip, and the *Ruta Baga* or Swedish turnip, which are raised everywhere and used as a table vegetable, as well as food for cattle. Planted or sowed as grain on stubbles. A sub-species is the *Teltowa Turnip.* ⊙.

The *Rape* (Brassica oleitera) has broad, heart-shaped leaves and yellow flowers; grows wild in Sicily and in the neighborhood of Naples, but, brought to Middle Europe, is cultivated for sake of the oil furnished by the seed, which is useful to burn in lamps and for greasing wool preparatory to carding. ⊙.

The *Radish* (Raphanus sativus) has long, lyrate, rough leaves and cylindrical, pendulous seed pods. Came originally from China, but has been cultivated since ancient times in Europe. Root large and fusiform, white, red, and frequently black. Has a pleasant taste, although pungent, and, some say, assist digestion. ⊙. There are many different species.

The *Garden Cress* (Lepidium sativum). Pepper-grass. Leaves variously incised and divided into linear segments; pods oval. Grows wild in the East, but in Europe and the United States is cultivated in gardens; blooms in June and July; has a pleasant, though pungent taste, and is used by many as salad. ⊙.

The *Woad* (Isatis tinctoria) has a smooth stalk; stem-leaves are arrow-shaped, radical or root-leaves wedge-like. Blooms in a panicle or raceme, has small yellow

flowers, and, as it yields a blue dye, it is frequently cultivated. ♂.

The *Shepherd's Purse* (Thlaspi bursa pastoris), upper or stem-leaves sagittate, radical or lower feathered; seed pods heart-shaped; flowers white; petals small. Grows everywhere in fields or on road-sides as a weed; nevertheless it is said to be good food for sheep.

The *Jericho Rose* (Anastatica hierochuntica). Leaves ovate and notched; white flowers without peduncles; seed-pods hairy. This plant is found growing in the sand in Palestine, Arabia, and Egypt; if dried for an herbarium, etc., it rolls its branches together like a ball, but many believe after being kept a year and a day, if it is placed in water, it will spread forth as if to life again. The superstitious regard it as a miracle, and from peculiar signs accompanying this singular faculty, predict whether the coming year will be fruitful or not.

The *Scurvy Grass* (Cochlearia officinalis). Radical leaves petiolate and heart-shaped; flowers white; pods bullet-like; stem-leaves oblong. Grows abundantly on the sea-coasts of northern Europe and in the neighborhood of salt springs; has a sharp, bitter taste, and is eaten—mixed with other vegetables—as salad. Considered as a specific in all diseases of the mouth, and particularly the scurvy, to which sailors are subject from the constant use of salted meat, it is much valued. It is occasionally planted in gardens. ♂.

The *Horse Radish* (Cochlearia armoracia). The root is thick, long, fleshy, and branching; the stem upright, with lanceolate leaves; the pods small and egg-shaped. It is cultivated in gardens everywhere; the root, which is the part eaten, is exceedingly pungent, and is much esteemed as a condiment for meats. 2ƒ.

EIGHTH FAMILY.—CAPARIDACEÆ are shrubs or trees with four-leaved flowers and six or more stamens; many of them bear berries. (Class 13, L.) The most remarkable is

The *Caper Bush* (Capparis spinosa), an ornamental shrub, from the flexible branches of which hang tender, pale-green, ovate leaves and light-red, or white, poppy-like flowers. They grow in thickets under city walls or on slopes in southern Europe; the buds are plucked off, laid for a few hours exposed to the air in the shade, and pickled with salt and vinegar. As their use is said to promote the digestion, they are highly valued as a condiment. The bushes die down to the root every year. ½.

NINTH FAMILY.—BIXINA.—(Class 13, L.) To this belongs

The *Orleans Tree* (Bixa orellana), and is rather a shrub than a tree, being about the size of a hazel-nut bush, which is cultivated in the damp grounds of the East and West Indies. The handsome green leaves are heart-shaped; flowers flesh-color; and the fruit, round and of the size of a chestnut, contain about forty seeds, each as large as a pea. They are surrounded by a red-colored fluid, from which the color known as *annotto* or nankeen color is made. ½.

TENTH FAMILY.—VIOLACEOUS PLANTS.—(Class 5, L.) The first is

The *Violet* (Viola odorata). Has broad, heart-shaped leaves, with five unequal flower petals, of which the lower is spurred. The flowers are blue, odoriferous, and furnished with a footstalk. This well known and favorite plant grows everywhere among the grass, by hedges and under shade; blooms in March and April,

and sometimes a second time, in Autumn. A pleasant perfume is extracted from the flowers, and also an essence which is said to relieve pain. ♄.

The *Dog Violet* is distinguished by its paler color and the entire want of odor.

The *Tri-colored Violet* (Viola tricolor) has leaves longish and dentated; flowers tri-colored; petals varied, violet, blue, yellow, or white; the lower one yellow, marked with seven dark purple stripes. This favorite and ornamental flower grows everywhere, and, blooming throughout the whole summer, may be called the pride of the garden; is known also by the names of *Pansy* and *Heart's Ease*. The Germans prepare from it a decoction said to be useful in purifying the blood. ☉ and ♂.

The *Dyer's Weed* or *Weld* (Reseda luteola) grows everywhere, on dust heaps or by waysides; the leaves are lanceolate; flowers arranged in a long spike, stand upright, and have from twenty to twenty-four stamens; cattle avoid this plant on account of its bitterness, but as it yields a fine yellow dye, it is cultivated. Found in Europe and the United States.

The *Mignionette* (Reseda odorata) resembles the foregoing; the flowers are delightfully odoriferous, and the plant itself, by no means acrid, is eagerly eaten by Canary birds. Native of Egypt. Both belong to Class 11, L.

Third Division.

With single fruit pods, seed bearers upright in the middle.

Eleventh Family.—Genus Caryophyllaceæ. Ca-

lyx tubular and serrated. (Class 10, L.) The species most noted is

The *Garden Pink* (Dianthus caryophyllus), also termed *Clove Pink* or *Carnation.* Calyx covered with short scales; five petals; long claws, unequally notched; originally a native of Italy, but now cultivated everywhere, and valued by florists for its fragrance and beauty. The leaves are pale green; the color of the flower was originally red, but, by careful culture, is now found of every variety of hue. The odor of this beautiful child of Flora is delightful, and florists engage in the cultivation of the Pink with an ardor amounting to passion. The most conspicuous specimens of the whole race, of which the Carnation is supposed the parent, are the *Dianthus Barbatus* or *Sweet William*, the *Armaria* or *Wild Pink*, *Plumarius Pheasant's Eye*, and *Dianthus Superbus*, etc. 2f.

The *Saponaria* (Saponaria officinalis), vulgarly known as *Bouncing Bet* or *Soapwort*, has lanceolate leaves inclining to elliptical; flowers growing in tufts, handsome and flesh-colored, with ten stamens and two styles. Grows in fields, by roadsides, or in gardens; stem from one to two feet high; the saponaceous juice found in the root can be used as soap. It has a bitter taste, and is often employed as medicine. 2f.

The *Cuckoo Flower—Ragged Robin* (Lychnis flos cuculi); stem rough and upright; leaves lanceolate and smooth; calyx wedge-shaped and ten-ribbed; petals divided into segments formed like a hand; color red, sometimes very pale, but seldom white. Very common in meadows or gardens.

The *Corn Cockle* (Lychnis githago), cultivated *Rose Campion*, is rough, with small, woolly leaves, reddish-

purple flowers; ten stamens, five pistils; seeds small, black and angular. This handsome weed grows in wheat fields often two or three feet high; is a great nuisance to farmers, as it makes the flour blue and the bread bitter. ♃.*

TWELFTH FAMILY.—LINACEÆ.—FLAXWORTS.—Class 5, L.

Flax (Linum usitatissimum) has small, lanceolate leaves, of a beautiful green color; stem upright, flowers large and blue; flower petals oval shaped, somewhat twisted. This useful plant grows wild or among grain in the south of Europe, but was largely cultivated in the north, until nearly superseded by cotton. The flowers close in the evening; the capsules are five-celled and globose; seeds mucilaginous and oily, are employed in medicine, and yield the *linseed oil* so extensively used in mixing paint, printer's ink, varnishes, etc. The fibers of the bark, very strong and fine, are manufactured into linen. ☉. There are inferior species, such as *Linum Rigidum*, *Linum Virginianum*, flowers yellow, and *Linum Diffusum*, found on wet prairies.

THIRTEENTH FAMILY.—MALVACEÆ.—(J., L., C. 16.) This genus is composed of plants or shrubs. A somewhat important class of plants, forming about one fiftieth of all the flowering plants of tropical valleys. In the Northern States they are all herbs. The most important product of the order is *Cotton*. The fruit is composed of twelve carpels arranged circularly around the calyx; the children sportively call them *cheeses*, a name very naturally suggested by their form. The Hibiscus and

* The *Scarlet Lychnis*, *Ragged Robin*, *Chinese Lychnis*, found both in Europe and the United States, belong to this family.

Lavateria belong also to the Mallow tribe, and, although foreigners, are now extensively naturalized.

The *Low Mallow* (Malva rotundifolia) is a small plant with delicate, roundish, heart-shaped leaves, white flowers, veined with purple; grows spontaneously in fields, or by roadsides, and found everywhere. The whole plant is mucilaginous; the seeds are brown and kidney-shaped. ♃.

The *Marsh Mallow* (Altheæ officinalis). The stem is upright, growing to a height of three or four feet, covered with thick, woolly down; leaves velvet-like, round, and heart-shaped. This useful plant grows wild in the damp grounds of southern Europe; in Germany it is cultivated on account of its medicinal properties; the flowers are of a pale flesh color, the root, about the size of a finger in thickness, as well as the other parts of the plant, abounds in mucilage, and is used not only as a specific in obstinate coughs, but as an emollient to promote suppuration. ♃.

Much resembling it is

The *Rose Mallow*, *Harvest Rose* or *Hollyhock* (Althea rosea), L., which grows above a height of six feet; stem hairy; flowers, springing out like ears of corn from the stalk, are mostly dark red; but there are numerous varieties of color, as well as single, double, or semi-double flowers. It is a native of the East. ☉.

The *Cotton Plant* (Gossypium album), plate 28, fig. 3, is a shrub with a cup-shaped calyx; leaves pointed, and from three to five-lobed; stem from two to four feet high, rough, and dark spotted; the flowers are large, and of a fine yellow hue; seeds white, numerous, and enveloped in a long white wool, are hidden within a capsule of parchment-like texture, which, when the plant has

arrived at maturity, bursts with a slight report. Although cotton is a native of Persia and the East Indies, it is now cultivated in the south of Europe, and forms a most important object of American agriculture. It requires a good soil, and to be kept clear of weeds. In October, when the pods, fully ripe, have burst open, they are pulled, and left to dry. The cotton is then picked out, freed from seeds, packed in large bales, and sent forth as a valuable article of commerce. There is another family of the cotton plant, having black seeds, and yellow wool, from which the genuine nankeen is made. h.

FOURTEENTH FAMILY.—NUCIFERA.—(CLASS 18, L.) We shall only mention one of this class.

The *Cocoa-nut tree* (Theobroma cacao). This tree, which seldom reaches a height of twenty feet, is a native of America; the branches are slender; the leaves, of a light green color, are about a span in length, and have a very long foot-stalk; the flowers are small and white; fruit, at first dark yellow, but, when ripe, spotted with brown; grows principally on the stem and larger branches; resembles a melon in form; contains a sweet, succulent, marrow-like substance, in which are found from thirty to forty kernels, about the size of a large bean, and of a pale violet color. Taken from the nuts, these seeds are left lying in heaps for a few days, in order to foment. Their color is now changed to a reddish-brown, in which state they are ready for exportation, and being almost entirely oleaginous, are called Cocoa Butter. The Caraccas cocoa is considered best, as it is more aromatic, and less greasy. It is easily distinguished by its lighter color. Moreover, if the cocoa-beans are mealy and bitter, they are roasted over a fire, ground or beaten, and mixed

with spices and sugar, form the article everywhere known as Chocolate. ♄.

Fifteenth Family.—Tiliacæe (Linden Blooms). —(Class 13, L.)

The *Common Lime tree* (Tilia europæa), Torr., has heart-shaped, sharp-pointed leaves. The flowers hang in clusters, and have a long leaf covering, or *cyme*, which is adherent to the flower pedicle. The fruit is globous, and ripens in October. Grows either in forests or free spaces; the roots spread very widely. Very hardy, the trees of this family often attain the age of eight hundred years, and measure more than twenty feet in circumference. The young trees will bear transplantation until they reach the thirtieth year. The wood, soft, light, and tough, is much used in cabinet work and by turners. The young branches are burnt, and form the crayons used in drawing; also, the blue-black necessary in the preparation of gunpowder, and is considered the best dentrifice known. The inner bark is very strong, and from the fibres, first softened in water, ropes, mats, and baskets are manufactured. The flowers of the European lime tree have a pleasant odor, and are sometimes used as tea. They are valued as food for bees, as they impart a pleasant flavor to the honey. The seeds yield a much prized oil, closely resembling that of almonds. ♄.

There are other varieties of Tilia, such as

The *Linden* (Tilia americana), Torr., also known as *Pumpkin tree* or *Basswood;* differing little from the foregoing; growing in forests, and reaching to eighty feet in height. Wood used in cabinet work and paneling of carriages. Another variety, found on the banks of the Mississippi and Ohio, is

The *Various-Leaved Linden* (Heterophylla), Pursh,

which never grows higher than from twenty to thirty feet.

The *White Lime* (Tilia alba), Mich., is found in the woods of the Middle and Western States. Trunk from thirty to forty feet in height. Fibrous portion of inner bark also used for fishing-lines, nets, and rice-bags. ♄.

SIXTEENTH FAMILY.—CAMELLIA.—(Class 13, L.) Are small shrubs and trees, with simple leaves, alternating on the stalk. Flowers consisting of five or more petals. The first of this family is

The *Tea Plant* (Thea chinensis), plate 28, fig. 4. The leaves are evergreen, smooth, lanceolate, rather long, and notched; the flowers stand singly. This well-known article of commerce is divided into two kinds, namely: Green Tea, the leaves of which, being dried, are of a bluish-green, and Black, because the leaves are brown or black. This shrub, valuable for the sake of its leaves, is a native of China and Japan, and being in general use as forming a favorite beverage for all classes, many efforts have been made to transplant the tea shrub to Brazil, and other provinces of South America. Its size is about the same as that of a currant bush; very branching; the bark is gray, the wood hard; the leaves numerous, and of the size and shape of those of the small, sour cherry, have very short foot-stalks. The smallest leaves on the top, the larger below; the first are considered the best; the latter, on being gathered, are divided into five portions, which bring different prices, according to their quality. The flowers are white, without fragrance, and much resemble the wild rose. The fruit, black, wood-like, is divided into three capsules, each of which contains one bitter seed not unlike that of the sloe thorn. The first time of gathering is in March, when

the small leaves, of two or three days growth only, are pulled. These, carefully dried, are the genuine imperial tea, which never, or very rarely, is exported abroad. The second gathering is had in April, and forms the different and best sorts of tea sent to other countries. The third crop is the common and cheap article of commerce, and known by various names. It is said that an infusion of the fresh leaves of the tea plant affects the brain injuriously; therefore, they are at once spread on tin plates, and placed in kilns until they become so hot that they can scarcely be handled. After this operation, they are rolled about on mats made of fine rushes until they are cold, during which process a green colored juice exudes from them. Many believe that green tea receives its color from being dried on plates of copper; this is, however, not true. The later leaves, which, when dried, form the varieties of black tea, are dipped in boiling water before drying. The same process is had as with the green, and, last of all, the precious article, now ready for use, is carefully put up in boxes lined with tin or pewter. These boxes, however, are kept a twelvemonth before being exported or brought into use, as the tea, operating powerfully on the nerves, is considered dangerous until a year old. Tea has been used as a refreshing beverage in China and Japan since the earliest times, but was not known in England before the middle of the seventeenth century. At the present time it is in such general use that more than 100,000,000 of pounds are exported. Latterly, however, it is much adulterated, being mixed with leaves of the ash and sloe thorn. The sea air is supposed to injure the flavor of tea brought in ships; therefore, that which is brought by the caravans,

through Russia or by the overland route, is considered the best. ½.

The *Camellia* (Camellia japonica) is a shrub not unlike the tea plant, and grows wild in all the hedges in Japan. The leaves, pointed, oval, and notched, are leathery but smooth and shining, as if varnished; the flowers, consisting of five petals, are large and beautifully colored; the wood of the stem is hard; the seeds are contained in a broad three-knobbed capsule, about the size of a hazel-nut; is valuable as containing a considerable portion of an essential oil, which is used for many purposes in the East; sometimes called the Japan rose. The colors are various—flesh-colored, bright red, rose color, and white. One of the most beautiful flowering plants, it is, with us, of difficult cultivation, requiring much skill and patience, as well as protection from the climate. There are two hundred varieties. ½.

SEVENTEENTH FAMILY.—AURANTIACEÆ.—(Class 13, L.) A noble genus of shrubs and trees, with fragrant fruit and odoriferous flowers. From the latter is obtained the oil of heroli, which, used in composition of cologne water and other perfumes, imparts its own delicious odor to them.

The *Lemon Tree* (Citrus medica) is large and lofty; height twenty feet; bark smooth; small branches, armed with thorns; leaves long and acute; smooth, glossy, and parchment-like. The flowers are violet color outside; within, white and very fragrant; fruit egg-shaped, and larger than an apple; the yellow rind, thick and very fragrant, contains an acid pulp, the agreeable juice furnishing the most refreshing drinks, well known as punch and lemonade. The seeds, whitish-yellow, are attached to the inner angle of the carpel, and vary from two to

six in number. A native of tropical Asia, it has been transplanted to southern Europe, and even in the north is successfully cultivated in conservatories. The fruit is seldom fully ripe when exported, as it decays readily. From the less perfect lemons, considered too small for commercial use, is prepared red citric and malic acids, which are sent abroad in the form of salts. ♄.

The *Citron Tree* bears a large fruit, filled with a firm, sweet, and very palatable pulp, and often weighs ten pounds; the rind is preserved with sugar and known as candied orange peel or citron, much used in confectionery.

Limes, with their purple flowers and small, smooth, and thin-skinned fruit, like large berries, and filled with acid juice, are another variety. The rind of one species, called the *Bergamot*, from its resemblance to the Bergamot pear, furnishes the essential oil, called Essence of Bergamot. ♄.

The *Sweet Orange Tree* (Citrus aurantium) is distinguished from the above described by the petiole or footstalk of the leaves being winged; the flowers are white and extremely fragrant. The fruit is large, round, golden-hued, very odorous, and filled with a rich, sweet pulp. When not fully ripe they have a spicy bitter taste, make an excellent preserve, and prepared with sugar, may be used in various ways; orange-water is prepared from the flowers.

The *China Orange*, with its smooth skin of lighter color, has a more spicy taste, and forms another variety.

The *Curacoa Orange* is considered the best; it is of medium size, the rind is thinner, greener, and more fragrant; the pulp is of a dark red color, and filled with juice, most refreshing to the taste. Natives of West

Indies and South America. ♄. According to Lindley, there are twenty thousand varieties of Citrus Aurantium.

The *Shaddock Tree* (Citrus decumana). Petioles winged; leaves obtuse or stumpy; the flowers hang in clusters, and smell like lilies. The oblong, knobbed fruit, often as large as a child's head, is of a pale yellowish-green color; often grows to the diameter of seven to eight inches, and weighs fourteen pounds. The rind is spongy and bitter; the pulp, purplish-red, has little taste. The fruit can be kept a considerable time, but only ripens perfectly in the East and West Indies. There is a relative species, called the *Gideon's Apple*, which is three times as large as a lemon; the pulp has an acid, but very pleasant flavor. It is often planted in gardens.* ♄.

EIGHTEENTH FAMILY.—HYPERICACEÆ.—(Class 18, L.) Are low shrubs, with reddish-colored sap and yellow flowers. The most common species is

The *St. John's Wort* (Hypericum perforatum), Willd. Leaves obtuse or often rather acute, with numerous pellucid punctures like perforations, and dotted with black. The handsome gold-colored flowers are numerous and arranged in terminal panicles; if rubbed so as to extract the juice, the fingers are colored red; the taste is bitter and balsam-like. Considered medicinal, the yellow flowers rubbed into olive oil are used as a remedy for burns and wounds. ♄.

The species termed *Hebradendron* are found only in the East Indies; the juice of the sap, dried in the sun,

* In a splendid French work, written in 1818, there are 169 varieties of the Aurantiaceæ described. Sweet Orange, 42; Bitter, 32; Bergamots, 5; Limes, 8; Shaddocks, 6; Lumes, 12; Lemons, 48; Citrons, 17. Cuttings best mode of cultivation.

is the well known Gamboge, used by painters in Aquarelle, and is also of some importance in medicine as a purgative.

NINETEENTH FAMILY.—HIPPOCASTANACEÆ.—BUCKEYE.—(Class 7, L.) Are trees or shrubs with knotty branches; leaves acute, dentate, sometimes digitate.

The *Horse Chestnut* (Æsculus hippocastanum) has leaves compound—digitate by sevens and fives—flowers arranged in tufts standing upright. This ornamental tree, often from sixty to eighty feet in height, with its dark leaves throwing a deep shadow and its white flowers, spotted with red and tinged with yellow, presents in spring a perfect specimen of rare and sylvan beauty. A native of Thibet and Northern India, it was introduced into Europe towards the close of the sixteenth century. The seeds, of the same color as those of the common chestnut, contain a farinaceous substance, but which can not be used on account of its bitter taste. Horses refuse to eat it, but sheep feed on it readily. The wood is used by carpenters, and the bark by tanners, also occasionally employed as medicine. ♄.

ACERACEÆ.—MAPLES.—The *Sycamore* (Acer pseudo-platanus) is a handsome tree; the leaves are heart-shaped and five-lobed; grows to a height of more than forty or fifty feet; flowers greenish-yellow, hang in clusters, and belong to the 23rd class of Linnæus, as they possess both pistil and stamen. The bark is smooth and exfoliates in thin plates. The wood is white, and not much esteemed; is occasionally sawed into joists and other lumber. ♄.

Sugar or *Rock Maple* (Acer saccharinum), found throughout the United States, is a tree of lofty proportions, often seventy feet in height, with a trunk three

feet in diameter. Leaves palmately five-lobed and dentated; flowers pendulous. Maple sugar, perhaps the most delicious of all sweets, is the product of this species; an ordinary tree will yield from five to ten pounds in a season. The wood is strong and compact, and makes the best of fuel. It is sometimes grained or curled like the red maple, but oftener presents that beautiful arrangement of fibre called Bird's Eye Maple, so much esteemed in cabinet work. The flowers are delicate and beautiful. ½.

The *Box Elder*, *Ash-Leaved Maple* (Acer negundo vel campestre), Linn., has heart-shaped, obtuse leaves, three or five-lobed and dentated; flowers stand in upright clusters; is a small tree or rather large shrub, with a rough bark. The hard wood is used by turners for various articles, and the roots furnish the well known Ulmer pipe-heads, so much prized in Germany. ½.

Twentieth Family.—Vitaceæa.—Juss. Shrubby plants, stems climbing by tendrils.

The *Wine Grape* (Vitis vinifera). (Class 5, L.) Flowers small and green; calyx minute and entire; five-toothed or petals four or five, inserted on the outside of the disk; hang in the form of grapes; fruit a pulpy berry containing from one to four hard seeds. The leaves are heart-shaped, ragged, and digitate. The grapevine was originally brought from the warmer regions of Asia, and thrives well in the south temperate zone; does not flourish so well in the north. In countries situated within fifty degrees north lat., vines are planted only on the sunny slopes of hills; but in the southern part of Europe, as Italy, Spain, and the Canary Islands, where, even along the roadsides, beautiful trees are planted so as to form regular avenues, vine cuttings are placed between

and suffered to climb in rank luxuriance upon the branches, and arching overhead, make a delightful arbor, completely screening from the rays of the sun. The grape is distinguished from the other vitaceæa by its hard wood and many-fissured rind. There are said to be fourteen thousand varieties belonging to the race. That wine is made from grapes is generally known, but the processes are as varied as the fruit. The following description refers to the present mode: The ripest grapes are separated from their clusters and shaken on a wire sieve, so arranged that they are freed from stems, which, if suffered to remain, would spoil the flavor of the wine. They are next placed in a vat, the bottom of which is bored full of holes; beneath this is another large vessel, where the juice of the fruit, crushed by machinery or otherwise in the upper vat is received. The skins mostly fall with the juice into the lower tub—if not in sufficient quantity, they are afterwards added. The whole mass is commonly left to ferment—a certain time being allowed for the purpose—as well as to give a deeper hue to the wine, for as the coloring matter is contained in the skins, it could not be sufficiently drawn out if the must was pressed as soon as crushed. Therefore, those who desire to make highly-colored wine are in the habit of frequently stirring down the skins, which rise to the top during fermentation. This mode of proceeding can only be used to advantage when the fermenting tubs are closely covered; for the skins coming in contact with the atmospheric air would become sour. After standing a sufficient time, a part of the fluid is drawn off from below; this, which is the pure juice, is clear, strong, and requires no pressing. The other portion, thicker, and mixed with seeds and hulls, is put into the press,

from which it comes forth clear, but as the juice first drawn is considered stronger, the whole is generally mixed together.

In order to have good wine, the first rule to be observed is in the gathering. Great care must be taken in selecting the grapes, allowing none that are unripe or decayed to remain among them; the second rule is, not to mix different species of the grapes together; and the third, and altogether necessary to be remembered, is to maintain the most perfect cleanliness. The wine being pressed, and having come forth clean from the strainer, is placed in barrels to undergo a second fermentation. This new and yet sweet wine, called *Must*, contains sugar, mucilage, tartaric acid, water, and an oily substance of a peculiar and pleasant odor, and coloring matter. The sweeter the new wine is, the more spirit will it possess after fermentation; after which the oily principle loses its delightful odor, the coloring matter its hue, and the sugar is changed into alcohol. The mucilaginous portion and tartaric acid mingle together, and after a greater or less effervescence, form carbonic acid. The gas arising from this latter element diffuses itself throughout the wine vault, and makes it dangerous for any one to enter, as it produces suffocation. It is customary to place pans of burning charcoal on the cellar floor in order to absorb this poisonous gas. During the fermenting process the wine becomes heated from fifteen to twenty degrees.

The husks or skins that remain after being pressed, are used partly by tanners or given as food to swine; and, last of all, good oil is made from the seeds. The fermentation having ceased, which is not before spring, the wine is drawn from the lees and put into new barrels.

Brandy and alcohol are made from the lees, and the tartrate of potash found on the sides of the fermenting vessels is used for medical purposes. If the wine is left exposed to the air, it undergoes a new fermentation, and becomes vinegar. As the saccharine matter has much to do in determining the strength of the wine, it is very common to dry the grapes partially before pressing in order to free them of the watery properties; this is done by spreading them out in the sun or in ovens slightly warm. This prevents the sugar from changing the wine into alcohol, and in the manufacture of sack and other sweet wines, is generally observed. In Italy, Greece, and Spain, grapes are dried and sent abroad as raisins; many are entirely without seeds. The wood of the stem and small branches, burnt into charcoal, is much used in the manufacture of printer's ink and black crayons. *Zante Currants* or *Corinthian Raisins* are made from a remarkably small grape called the *Black Corinth.* There are incredible varieties of grapes, in France alone are fourteen hundred; the different kinds are used for making different wines. Rhenish wine is made from the *Risling;* Champagne from the *Clevner;* the Burgundy, Traminer, and Muscadine are much esteemed as the best European wines. The American species are Vitis Labrusca, Isabella, Catawba, Raccoon, etc. The *Labrusca* or *Fox Grape* is a native of the Northern States, has been cultivated in Europe; the fruit has the flavor of the *Muscatel.* ♄.

The *American Ivy* or *Woodbine* (ampelopsis hederacea), Michx., is easily distinguished by its five-fingered dentate leaves, and, as autumn approaches, its beautiful red foliage. It has long been cultivated as a covering for walls and arbors; its radiating tendrils fastening

everywhere, it climbs to the height of fifty feet. It bears a dark blue berry, which is not eatable.

TWENTY-FIRST FAMILY.—GERANIACEÆ.—(Class 10, L.) Are hardy plants, with many-lobed leaves, flowers opposite. Pelargoniums, or common geraniums, not so hardy as to bear the winters in a northern climate, belong to this class, and, largely cultivated as garden and house plants, are well known from their beautiful flowers and sweet odor.

The *Red Stork's Bill* (Geranium sanguineum), L., Her., has an upright stem, diffusely branched, reddish leaves, and dark, blood-red flowers; a foot and a half high, grows in woods and dry, grassy places, but finds a place in gardens on account of its beauty and sweet perfume. ½.

The *Crane's Bill* (Pelargonium) belong to this family. Are distinguished by the irregular, two-lobed petals, and stamens partially sterile. Natives of the Cape of Good Hope, where they are found in endless variety. Many have been transplanted to the gardens and hot-houses of the north, and not less prized as being highly ornamental than for the delightful odor of the leaves.

TWENTY-SECOND FAMILY.—TROPACOLACEÆ.—TROPHYWORTS.—(Class 8, L.) Are straggling or twining, with orbicular leaves and large, showy flowers.

The first of this genus is

The *Nasturtium—Indian Cress* (Tropæoleum majus), which has the calyx five-parted and spurred at the base; flowers composed of five unequal petals, three of which are clawed, the two upper inserted on the calyx; of a bright orange color, brown spotted. The fruit a seeded nut, divided into three globes. Both flowers,

stems, and fruit have a pleasant, aromatic, and pungent flavor, and, eaten as salad, and the unripe fruit prepared as a condiment, is a tolerable substitute for capers. This beautiful race, sometimes called *Trophyworts*, came originally from Peru, but are now cultivated largely in the United States. There are forty varieties. ☉. Receives its name *tropæum*, a trophy, from the resemblance of the leaf to a shield, the flower to an empty helmet.

Twenty-Third Family. — Oxalidaceæ. — Wood Sorrel.—(Class 10, L.) Are low or herbaceous plants, growing in all parts of the world.

The *Common Sorrel* (oxalis acetosella). Calyx and flower composed of five petals; seed contained in a capsule, which bursts, scattering the contents elastically. Leaves are heart-shaped, five-lobed; the flower is white, and without odor. The whole plant has an agreeable acid taste, and the juice extracted and mechanically prepared, forms oxalic acid or salt of sorrel, which, in large doses, is highly poisonous. Found in woodlands and fence rows. Blooms from May to July. 2ℓ.

The *Sensitive Plant* (oxalis sensitiva) has small feathered leaves, with leaflets from 6–16 pairs; lower sides shining purple. The leaves retract or shrink at the slightest touch or breath, folding themselves so closely that the purple color can not be seen. The flowers are small and yellow; the seeds are contained in capsules, which, when fully ripe, burst open and scatter the seeds often to a distance of five or six feet. This species is native of the East Indies, where the people regard it with superstitious reverence, and attribute wonderful properties to it. 2ℓ. Found also in America.

SECOND SUB-CLASS.

Flowers with one or many petals adhering to or inserted on the calyx.

TWENTY-FOURTH FAMILY. — RHAMNACEÆ. — (Class 5, L.) Are shrubs and trees well provided with thorns. Natives of temperate countries; flowers small; calyx tubular and campanulate. The first is

The *Buckthorn* (rhamnus cathartica). About six feet high; leaves growing in tufts, oval, and doubly serrated, flowers small and of a greenish-white, blooms in May. The pea-like berries are black, of a bitter taste, and act both as a cathartic and emetic. Bark and unripe fruit contain a yellow dye; sap green is made from the ripe berries, and, also, when over-ripe, a beautiful purple, both much used by water color painters. ½.

The *Alder-Leaved Buckthorn* (Rhamnus frangula), Michx. Rather low, leaves oval, entirely serrate; flowers mostly with five stamens, and bi-sexed. Fruit-berries at first red, afterwards black. Very common in the woods of Europe; the reddish-colored wood is much prized by cabinet-makers and turners; besides, burned into charcoal, it is preferred before any other in the manufacture of gunpowder, therefore it is often called powder-wood. ½.

The *Jujube* (zizyphus vulgaris) is a shrub found in Italy and Spain, with few thorns; short, oval leaves, much toothed; fruit droops about an inch long, light red, containing a gelatinous pulp in which a single seed is enveloped. The dried fruit is much esteemed as a specific in all pulmonary affections.

The *Thorn of the Cross* and *Zizyphus Latus* belong

exclusively to southern climates; the first is believed to be the same genus as that from which the cross on which the Saviour suffered was made; the latter, which grows only in northern Africa, is known through the Odyssy. ♄.

Next in order is

The *Holly* (Ilex aquifolium). A large bush, with smooth, green bark on the branches; leaves evergreen, oval, leathery, and spinous; flowers white, hanging in pedicels, and very red berries. The wood is fine grained, compact, useful in turnery, etc. *Ilex* is the ancient name of the *Holm Oak*, *Hollyworts* or *Aquifoliaceæ* of the race in general. Genera 11, species 110. Natives of America and Africa. Only one, the Holm oak or Ilex being found in Europe. ♄.

The *Spindle Tree—Burning Bush* (euonymus europæus) is a handsome shrub from four to twelve feet high, with ragged, angular branches; leaves elliptical, pointed, and notched. Flowers greenish-white, hanging forkedly in clusters. The fruit is four-cornered rather than globular; capsules crimson and smooth; seeds white, inclosing a green kernel. Grows in gardens, or wild in the Southern States; the wood is valuable to turners, and the small branches make good charcoal crayons. ♄.

Twenty-fifth Family. — Terebintheæ.—(Class 2, L.) This family belongs to the shores of the Mediterranean; is well known and valuable as furnishing useful gums and fruits resembling almonds.

The *Pistachio Tree* (Pistacia vera), of moderate size, was brought originally from Persia, but is now common in Italy; the male flowers are in catkins; the female hung in simple clusters. It bears nut-like fruit,

inclosed in a pericarp, about the size of a hazel-nut; the kernels, used as almonds, are pale green and oily; the envelope is reddish-colored. ♄.

The next relative is

The *Mastic Tree* (Pistacio lentiscus), and furnishes the resinous substance called frankincense and gum mastic, which exude in drops from its trunk. Closely related to it also is

The *Turpentine Tree*, grows in the Island of Cyprus and Italy, and is valuable for the excellence of its gum, which is known as Venice Turpentine. ♄.

The *Smoke Plant* or *Venitian Sumach* (Rhus cotinus), Nuttall, is chiefly a native of tropical regions, represented in the United States by the genus Rhus only. It is a shrub with leaves rather oblong than oval, veined like network (reticulated) and furnished with footstalks; the flowers small and of a greenish-yellow, hang in panicles.* After blooming, the unfruitful footstalks become long, diffuse, and feathery, showing in the distance as if the plant were enveloped in a cloud of smoke. Sometimes it grows wild, but is often planted in gardens, its singular appearance rendering it quite ornamental. In Italy the plant is used for tanning. ♄.

TWENTY-SIXTH FAMILY.—PAPILIONACEÆ.—(PULSE FAMILY)† are mostly plants or shrubs—seldom trees—which furnish a vegetable diet for man or food for animals. The flowers are of rather singular structure,

* Found wild in Arkansas, where it grows to a height of six feet. There are ninety-five species of the anacardiaceæ. The *Cashew Nut* is the product of a small tree of both Indies, and belongs to the Anacardiaceæ.—*Tr.*

† Belonging to the Order Leguminosæ, which is one of the most extensive and important. It yields to medicine and the arts its full proportion of the substances derived from the vegetable kingdom.

having two lateral petals called wings and two lower ones which, converging together, form a body named the Carina, or Keel, from its resemblance to a boat, and serves to enclose the stamens and pistil. If our young student will examine the nearest bean blossom, he will find a better explanation than can be conveyed by terms; there are nine coherent (diadelphous) stamens, and one free; therefore the Papilionaceæ rank in the 17th class, L. The fruit, or rather seed, is contained in pods, and is mostly eatable. To this division belongs, first,

The *Tragacanth Tree* (Astragalus tragacantha). It is shrub-like, with numerous leaflets—ten pairs—small and oblong; the flowers are pale-red. A native of the East, it furnishes a gum which exudes from its bark, which is very useful in Materia Medica and the arts. The gums Arabic, Cino, Senna, Catechu, also belong to this tribe. Related to this family is

The *A. Bactricus*, valued and cultivated on account of the seeds, which are said to afford a tolerable substitute for coffee. It is also known by the name of Swedish coffee; but it is hardly likely that this plant will ever be of much account in this country, as coffee-drinkers are not apt to admire substitutes for their favorite berry. ♄.

The *Indigo Plant* (Indigofera tinctoria), plate 27, fig. 5, is a low tree or rather a tall shrub, two to three feet in height, with six or eight pairs of cleft leaflets; their shape is oblong, rather than oval, and the red flowers are arranged in short clusters. The indigo plant is a native of the East Indies and China, but has been transplanted to the West Indies, where it is now cultivated in many places. The seed is sown in a rich, light soil, requires much culture, and must be carefully nursed

and weeded In two months from the time of planting, and before the flowers appear, the leaves are cut off and dried in the sun; after this, they are laid for a few days in a kind of stone vat, from five to six feet deep, which is then filled up with clean water in order to extract the coloring matter, a process during which fermentation is produced. The preparation of Indigo is considered a most unhealthy occupation, therefore many of the provinces, for instance Surinam, where it used to be carried on to some extent, have given it up, and the planters have turned their attention to other, more agreeable and healthful, if not more profitable employments. The coloring matter which is about as thick as mud, settles on the bottom of the vat, whence it is removed, put into linen sacks, dried, and exported as an article of commerce. B. L.

Clover (Trifolium), Tourn. The clover family consists of small, juicy plants, which grow everywhere, in meadows, fields, or woods; flowers situated on small pedicels, are head-shaped; considered as excellent food for cattle. The best known of the clover genera are, first,

The *Meadow* or *Red Clover* (Trifolium pratense), is well known, being largely cultivated everywhere; its red flowers not only adorn the meadows, and with the leaves furnish excellent fresh pasture for cattle, but, filled with honey, attract the bees, which may be seen hovering over them all day long. The odor of ripe clover is delightful, nor is its usefulness ended with the summer, for cut down by the scythe of the mower, dried in the sun, and made into hay, it is most valuable in the winter for feeding cattle. B.

Creeping White Clover (Trifolium repens). Stems rather creeping and diffuse; lying on the ground, and

branching from roots; inversely ovate; flowers white, or globose heads on erect naked stalks. Found by roadsides and in meadows, where it is cultivated, being considered excellent fodder for cattle. 2f.

Bird's Foot Trefoil (Lotus corniculatus), has an upright stem; is three-leafed; leaflets strongly developed; flowers yellow, appearing on heads oval or conical; known also as *Yellow* or *Hop Clover*. Native of Europe. Hab. of sandy ground or road sides. 2f.

Stone Clover (Mellilothus officinalis), Tourn., Endl.; has a branching stem; leaves serrated or notched; the flowers are yellow, hang in beautiful racemes, and not unlike the blossom of hops; therefore it has received the name of hop clover. Not particularly valuable as fodder but sometimes used in medicine. 2f.

The *White-flowered Mellilot* (Mellilotus cœroleus). This plant, *M. Corulea* of Lam., now the *Frigonella cærulea* of D. Cand., of strong and enduring odor, is employed in Switzerland to give the peculiar flavor to the famous Schabzieger, or, as it is usually called in the vernacular, *Sap-sago* cheese. It has a stout erect stem, from two to three feet high; flowers pale-blue; leaves three-lobed; comes originally from Africa. Introduced into the United States from Europe; only partially cultivated. 2f.

Lucerne (Medicago Sativa), Tourn., Endl., *Snail Clover* or *Blue Everlasting Clover*, for in Europe it is known by all those names. Stem erect and smooth; leaves oblong and untoothed; flowers blue and standing in clusters. It is in considerable demand in Europe, as it makes excellent fodder, and yields a profitable crop for ten years. 2f.

The *Sain-foin Esparsette* (Hedysarum onobrychis),

L., or *Red Everlasting Clover*, has a stem from one to two feet high, branched, smoothish. Leaflets feathered, flowers beautiful red color, grow in clusters, cone-shaped, and, like the foregoing, yields a profitable crop; thrives well even on poor lands, and does not require frequent renewing, but lasts for many years. Is much cultivated in Europe. All of the clover genera, when dried into hay, are highly valuable as furnishing excellent fodder; there is, however, one great drawback in suffering cattle to graze among fresh clover, as, when eaten to excess, it swells in the stomach, and kills the animal. ♃.

Tremulous Shield Clover—Sensitive Joint Vetch (Hedysarum gyrans), grows in the East Indies; the stalk, three to four inches high, is smooth, and about as thick as one's little finger; large end leaves two to four inches long; side leaves smaller, half an inch long; flowers, violet, verging into reddish-purple; stand in panicles; the seed is kidney-shaped and black. This plant has the singular property of always being in motion. Its movements, however, are not excited by the contact of external bodies, but solely by the influence of the sun's rays. When the sun shines the leaves move briskly in every direction; their general motion is, however, upward and downward, but they not unfrequently turn almost round, and then their footstalks are evidently twisted. These motions go on incessantly as long as the heat of the sun continues; but they cease during the night or when the weather is cloudy or cold. It does not live long. When brought to Europe, as it is occasionally, it must be nursed carefully in a conservatory. ☉.

Broom Grass (Spartium scoparium) grows into a bush from five to six feet high; branches green and

angular; leaves simple and ternate; flowers large and yellow. Found in woods, hedges, or on hill-sides; used for making brooms and baskets. Hares eat it greedily. ♄.

Liquorice, Sweetwood (Glycyrrhiza glabra), the product of a bush which grows wild in Spain, France, and Italy, is sometimes cultivated as far north as Germany. The root, which is the part used, is about two inches in circumference, woody, sometimes four feet long; brownish-yellow on the outside, bright yellow within; tough, and has a sweetish taste; the leaves unequally pinnate and somewhat gummy; flowers pale blue, clustering, hanging in racemes; fruit, a pod containing many small seeds. The liquorice plant is more generally cultivated in the south than in the north; requires but little care. The juice of the root boiled down to a certain consistence, furnishes the article sold as liquorice, and well known to children. The manner of preparing it, is to cut the root in small pieces, crush or grind them in a mill, like the sugar cane, and then boil the juice until of the requisite thickness. Afterwards it is next molded into shapes, enveloped in the leaves of the bay berry, wax myrtle (Myrica cerifera), and sent abroad as an article of commerce. Some care is requisite to keep it from burning, and it has been known to injure, when mixed with the particles of copper supposed to be scraped from the boiler. ♄.

The *Broom* (Genista tinctoria). Calyx two-lipped; branches upright, round, and striated; leaves woolly and lance-shaped; fruit-pods smooth and straight. Grows on hills or mountain-sides; height of stalk about two feet. Blooms from July to August; contains a yellow juice, from which is prepared the pigment known as

Dutch Pink, and used also in painting as yellow, and, mixed with Prussian blue, green. Tastes very bitter. ♃.

The *Locust* (Robinia pseudacacia), also called the *Acacia*, is a large tree, often measuring forty feet in height, and of varied circumference, sometimes two or three feet in diameter. The wood is yellowish, hard, and brittle; therefore it is seldom planted in places exposed to gusts of wind, as the branches are easily broken. The small branches are rod-like and furnished with thorns. Leaves oval, flowers very fragrant, white, and hang in clustering tassels. This beautiful tree deserves more favor than it receives, as it is not only ornamental but valuable; its hard wood, enduring for years, is particularly useful for making posts, railroad ties or sleepers, and its sweet-smelling flowers, containing much honey, are great favorites with the bees. There are several species, the most remarkable of which are the *Honey Locust* or *Threethorned Acacia* (Gleditschia tricanthos), the *Clammy Locust*, with branchlets and leaf-stalks clammy; flowers crowded in oblong clusters, tinged with rose-color, nearly inodorous; and the *Crown Locust*, the branches of which are so arranged that the top of the tree resembles a crown. ♄.

Lentils (Ervum lens), Tourne., are everywhere cultivated in kitchen gardens; about one and a half feet high; stalks weak; leaves oval and numerous; hang on climbing stems; flowers pale blue; pods short and two-seeded. The whole plant is esteemed good food for cattle; the seeds are used as a vegetable. ☉.

Vetch or *Tare* (Vicia sativa), Tourn., Endl., has a short flower stalk, with oval, oblong leaves; bears two upright pods with round seeds; grows among grain as a troublesome weed, although it is sometimes cultivated as

food for cattle. There are several varieties found in the United States: *Hairy Vetch* (Vicia Hirsuta); *Tufted Vetch* (Vicia Cracca), and *Wild Vetch* (Vicia Americana), regarded as weeds.

The *Common Field* or *Windsor Bean* (Vicia faba), Moench. Stalk rigid erect, with oval leaves; flowers white, spotted with black; bears three legumes or pods, which, on being ripe, turn black, and contain very large seed, with the large hilum or scar at one end. Used principally as food for cattle; the unripe seeds are, however, often applied to table use. ☉.

The *Common Garden Pea* (Pisum vulgare) is cultivated everywhere; roundish leaf-stalks; leaves oval, ternate; tendrils long and branching; flowers white and numerous; pods or legumes about two inches long, and sometimes, when unripe, are eaten. The seeds, however, are highly esteemed as a delicious vegetable. Some of the family are dwarfs, others climbers, and require rods for support. The plant is, however, too well known to require any farther description. ☉. There are several varieties of flowering peas—*Painted Lady*, *Sweet Pea*, *Everlasting Pea*, etc.

The *Common Bean* (Phaseolus vulgaris) grows higher than the pea, requiring a pole for support, although some species are low and dwarfish; these are called *Bunch Beans*, supposed to be natives of the East Indies, but cultivated in Europe from the earliest times. The stem, five to eight feet long, twining against the sun; leaves pointed and heart-shaped; flowers white, blooming in clusters; pods flat, and while young, constitute the favorite dish called string beans. The seeds contained in the mature fruit are also much esteemed as an article of food. There are many varieties, *Bush* or *Kidney Bean* (Phascolus

Nanus), *Lima Bean* (Phaseolus Lunatus), etc. The handsomest of the species is

The *Fire Bean*, *Turkish Bean*, which, found in the warmer portions of America, blooms throughout the whole summer, even until late in autumn. It is considered very ornamental, and cultivated on account of the rare beauty of its deep-red flowers; seeds white or purple spotted, and very large. ☉.

The *Tamarind Tree* (Tamarindus Indicus) is a very high tree, which, in the East and West Indies, Arabia, and Middle Africa, is planted in front of houses, as the linden is in Europe. The crown is very broad and leafy; the leaves oblong or oval. The flowers are white, and hang in small clusters. To these flowers follow dark brown pods or legumes, about four inches long; within these shells, which are very brittle, is found a pulpy mass of an acid taste, that is used either as medicine or a refrigerant in fevers; in the East, however, it is boiled into a syrup with sugar, and used as a delicious preserve.

St. John's Bread Tree (Ceratonia siliqua) is a bush found very frequently in Southern Europe and the East; sometimes, but rarely, grows to the height of an ash; leaves evergreen and feathered; leaflets smooth and oval; flowers red, and hanging in racemes or clusters. The fruit is a reddish-brown fleshy pod, about four inches long, which contains a sweet, mucilaginous substance—a kind of vegetable marrow; the seeds or kernels are dark brown, and very hard. The fruit is used in Germany either fresh or dried; known as *St. John's Bread.* In Spain it is used to feed horses, and in Egypt they prepare a kind of honey from the juice. ♄.

The *Gum Acacia* (Acacia gummifera). Leaves twice

pinnate, leaflets numerous, small, oblong, five to seven pairs; it is a high tree, trunk one foot in diameter, bark black, branches armed with numerous thorns. Flowers bloom in small clusters; pods six inches long, and filled with brown seeds. The sap, which abounds in this tree, and exudes from the bark—as the gum from the common cherry—furnishes the well known *Gum Arabic* of the shops. It is the type of all gums; many species of acacia, as well as the plum and cherry yield it. Used in Europe and America partly for medicinal, and partly for various other purposes. In Arabia, Egypt, and Senegal, where the tree is native, the inhabitants use it as food. ♄.

The *Sensitive Plant* (Mimosa pudica) has a stem clothed with prickles and bristles; leaves twice pinnate and digitate; leaflets small, linear, and of many pairs; seldom reaches above two or four feet in height; stalk reddish colored, with crooked thorns. If the leaves are even slightly touched they suddenly shrink, and, together with the branch, bend downward to the earth. A native of South America, but cultivated in the conservatories of Europe. ♃.

Twenty-seventh Family.—Rosaceæ or Rose Genus.—(Class 13, L.) Are plants with regular flowers, numerous distinct stamens inserted on the calyx, and 1.— with many pistils, which are quite distinct, or (in the *Pear Tribe*) united and combined with the calyx tube. Seeds few, and without albumen. Leaves alternate, and with stipules at the base of leaf.

The *Almond Tree* (Amygdalis communis) much resembles a peach tree. The calyx is campanulate, five cleft, and colored; with five petals. The flowers solitary or in pairs, mostly alone, and of a beautiful rose color.

The almond tree bears a stone fruit, with a very thin, dry, uneatable pulp; the whole is enveloped in a greenish colored woolly skin. Within this green pod is the fruit or kernel, the well known, rich, and well-flavored *Almond*. Native of North Africa, Palestine, and Greece. One species, the *Bitter Almond*, contains, besides a richer oil, useful for many purposes, the more formidable ingredient known as *Prussic Acid;* therefore the bitter almond is altogether poisonous to small animals, and can not be eaten, except in small quantity, by human beings, without fatal consequences. Sometimes cultivated as far north as the milder portions of Germany, mostly as grafted on another tree of the same family. One species has a very slight, fragile shell, and called the *Paper Shell*, is preferred by many. ħ.

The *Single Flowering Almond* (Amygdalis nana), Willd., about three feet high, and branching; leaves ovate and finely toothed; flowers numerous. Petals oblong, obtuse, and rose-colored. Blooms in May or June. 2f.

The *Dwarf Double Flowering Almond* (Amygdalis pumila) is a low shrub, highly ornamental, common in cultivation. Stems two two three feet high, branching. Leaves lanceolate, acute at each end, and smooth. Native of China. Flowers very numerous, clothing the whole shrub in their roseate hue, while the leaves are small. Blooms in May or June. 2f.

The *Peach Tree* (Amygdalus persica), Tourn. Named from Persia, its native country. Leaves, lanceolate and serrate; flowers solitary, appearing before the leaves; drupe or seed, with the flesh or pulp white or yellow; outer covering woolly. The kernel is very bitter, and contains a considerable quantity of Prussic acid. Among

all the stone fruits the peach occupies the first place, on account of its delicious flavor and healthful influence of its juicy pulp. About two hundred varieties of this much esteemed fruit are now named and described in the catalogues of American nurserymen. Trees rather short-lived. The double flowering peach is a highly ornamental variety. ♄.

The *Nectarine* (Persica lævis), De Cand. This small tree is scarcely to be distinguished from the preceding, except by its smooth fruit, which presents the same variety of clingstone and freestone. It is more rare than the peach, and generally smaller. ♄.

The *Apricot* (Prunus armeniaca) is a middle-sized tree, with broad, smooth, ovate, serrate leaves; stout, spreading branches; flowers, solitary, or in pairs, petals pinkish-white, preceding the leaves. The yellow fruit is clothed with a soft, velvety pubescence; one side slightly reddish. Came originally from Epirus, and was known to the ancients as the *Malus Epiroticus*. The drupe of the common apricot contains a bitter kernel, although there are some kinds of which the kernel is sweet, like that of the almond, and yields a rich oil. Cultivated in gardens as rare fruit. ♄.

The *Common Plum Tree*, or *Damascene* (Prunus domestica), originally from the East, was brought to Italy in Cato's time. Has oval, lanceolate leaves; white, myrtle-like flowers; fruit oblong, pulpy, and juicy. There are many varieties. The round or globe-shaped plum is considered the true plum; the oblong, the Damascene, or Plum of Damascus. Both are covered with a beautiful purple bloom, which is easily removed. Gages, green and yellow. The *Red Plum* (Prunus americana), and *Chickasaw Plum* (Prunus chicasa), are among the

varieties. The fruit is used largely, either fresh, dried, or preserved with sugar. In Europe a kind of brandy is distilled from the juice, and the wood is employed in fine cabinet work. ♄.

The *Wild Bullace Tree* (Prunus institia) is a shrub, or small tree; branches somewhat spiny; leaves ovate-lanceolate; pubescent-villous beneath; fruit black and globular; drupe rounder and smaller than the above mentioned species. Is the original of highly cultivated species, known in Germany by the names of Renkloden, Mirabel, and Cybart. Brought from Europe to the United States; naturalized on the banks of Charles River, in Cambridge, road-sides at Cohasset, and other places in the vicinity of Boston. ♄.

The *Black Thorn—Sloe*—(Prunus spinosa), Pursh. A thorny shrub, ranging in height from six to twelve feet; leaves, obovate, elliptical; flowers, solitary, white; fruit scarcely as large as a hazel-nut; drupe globous; pulp somewhat harsh to the taste; not ripe until winter, in which season only it can be eaten. In Europe, wine is made from the fruit, which tastes like port wine, and is of a beautiful red color. The flowers are used as tea; not only as a beverage, but are considered useful in purifying the blood. ♄.

The *Cherry* (Prunus cerasus), Juss. The cherry tree is often forty feet in height, with smooth, grayish-black bark; leaves, oval oblong, unequally notched, or serrate, abruptly pointed; branches spreading; flowers white; fruit globular, hanging in small pedicels of from two to three. Originally, the fruit of this tree was not larger than peas, as is still the case with the *Wild Cherry* (Prunus avium), De Cand., which many naturalists describe as a peculiar genus. Drupes globous and fleshy;

seed, stone-like and hard; kernel very bitter. A considerable portion of brown gum exudes from the back. The fruit has been much improved by cultivation, both in size and flavor. There are but two original species of cherry trees, viz: the sweet *English Cherry Ox Heart*, and the common *Sour* or *Morello Cherry*. The numerous varieties produced by long culture—the *Mayduke*, and others—may all be referred to one or the other of these two; though Professor De Candolles distributes them into four species. The *Sour Cherry* is the most common and most valuable for culinary purposes, whether used fresh from the tree or in a dried state. The *Morella*, a fine variety, with a rich purple juice, was used, in former days, for making brandy or cherry bounce. The latter is distinguished from others of the race, by its smooth, leathery leaves. Cherries were originally brought to Rome from Cerasus, a city of Pontus, in Lesser Asia, first by Crassus, or Lucullus, seventy years before the Christian era, whence their name, *Cerasus*. *Choke Cherry* (C. serotina), Hook, and *Sand Cherry* (C. pumila), Michx., are natives of the United States.*

The *Grape* or *Choke Cherry* (Prunus padus), De Cand., is a shrub or tree, with elliptical, doubly serrate leaves; white flowers; the fruit, small berries, hangs in clusters, black; seed round and hard; taste, astringent and bitter. Found in damp woods, but often planted in gardens as an ornament. ♄.

The *Cherry Bay* or *Cherry Laurel* (Prunus laurocerasus). Leaves oval, lanceolate, slightly notched, evergreen; flowers, white, upright, and arranged in clusters.

* It is stated that there are one hundred and twenty-five varieties of the Cherry, of which fifty belong to the Red Morello.

The fruit, resembling black cherries, oblong, and pointed at one end. Native of Trebizond, but frequently planted in the countries bordering on the Mediterranean; sometimes as far north as Germany, where, however, the fruit never ripens. Fruit is thin, black, of a sweetish taste, but not poisonous. Leaves, flowers, and kernels contain a large quantity of prussic acid; wherefore, if eaten in large quantity, they are not only dangerous, but prove a a deadly poison. The taste resembles that of bitter almonds. ♄.

The *Strawberry* (Fragaria vesca), Alpine, Wood, or English Strawberry. Calyx concave, deeply five-cleft; receptacle oblong; becomes enlarged and conical, pulpy and scarlet, forming the fruit, and bearing the minute, dry *achenia*, or seeds, scattered over its surface. Leaves oblong, notched, hairy, and ternate; stems, or rather runners, creep over the earth for several feet, occasionally taking root, thus serving as a propagation of the plant. Flowers in May or June. The flavor of the wild strawberry is considered superior to that of the cultivated, of which there are many varieties. Among them is the *Hautboy* (F. elatior, Ehrh.)—Chili strawberry and Hovey's Seedling—a relative species, which blooms perpetually. Is in Europe cultivated in gardens by way of ornament, and trained to climb on a trellis. The fruit, however, although beautiful, has no flavor. ♃.

Cinque-Foil—Five-Finger—Goose-Grass (Potentilla anserina). Stem creeping; leaves irregular; velvety above. silver-hued below; feather-veined; flowers, yellow; receptacle dry and persistent. Native of Lapland and Norway, but very common in North America. Grows in pasture fields and by road-sides. Said to be a

specific in curing the thrush or sore mouth of cattle. 2f. Many varieties.

The *Raspberry* (Rubus fruticosus), Tourne, Endl. Leaves pinnate, unequally toothed, oblong, and palmate; stalk and branches armed with briars; flowers white, composed of five petals. Found growing wild in woods or waste fields, and creeping along the earth, and frequently taking root, makes whole acres inaccessible, forming a tangle of briars. Fruit broad, composed of minute globules or carpels, on a protuberant, spongy receptacle, either deciduous or persistent. Flavor very pleasant; considered wholesome and refreshing. Wood, burnt into charcoal, is used in Europe in the manufacture of gunpowder. ♄.

The *Antwerp Raspberry* (Rubus idæus), De Cand. Lower leaves pinnately three or five foliate; leaflets broad-ovate, cottony on under surface. Stem and branches erect or procumbent, and armed with prickles. Found in Europe; native of mountain forests or stone-covered hills. Transplanted in the United States. Cultivated largely in gardens, on account of its fragrant and well-flavored fruit. The bright red berries are used in a fresh state as fruit; preserved with sugar, or prepared as jam or raspberry vinegar, are every where much esteemed. There are many varieties, as the *White Raspberry* (Triflorus), *Three-Flowered*, and *Thimble-berry* (Rubus occidentalis), etc., found in Canada and the United States. ♄.

The *Blackberry* (Rubus villosus), Ait. Calyx spreading, five-cleft; petals five, deciduous. Half shrubby plants. Stems armed with prickles; fruit inseparable from the juicy, deciduous receptacle; consists of about twenty roundish, shining, black, fleshy carpels, collected

into an ovate or oblong head; subacid, well-flavored; ripe in August and September. Several varieties, all growing wild. *Bristly Blackberry* (R. hispidus), De Cand., *Dewberry* (Rubus canadensis, or trivialis), Ph., which is a fine fruit, and generally preferred before the others. Valuable medicinal qualities are attributed both to the berries and the root. ♄.

Rose Family.—Rosaceæ.—Juss. This tribe is remarkable for the number and variety of its genera. The rose-bush, naturally low and shrubby, can, by cultivation, be made to attain to a considerable height. Leaves five to seven, feather-veined; leaflets, elliptic-lanceolate. Flowers, mostly solitary; sometimes single, consisting of but five petals (the latter greatly multiplied by culture); large, beautifully colored and delightfully fragrant; stalk and branches armed with numerous recurved thorns and prickles. The rose, distinguished by its beauty and fragrance, has been most appropriately termed the queen of the flowers. The fruit is the fleshy or berry-like red calyx-tube, called a *Hip*, which contains, within a rather hard envelope, a sweetish pulp, enclosing numerous seeds, surrounded with bristle-like hairs. The rose is, however, seldom propagated by seeds, but rather by offsets or cuttings. The roses of Persia and Cashmere, celebrated for their odor, furnish the delightful perfume known as "Otto of Roses," which is so costly that but few can afford to buy it. Nevertheless, one drop is sufficient, so penetrating and enduring is its fragrance, to perfume a wardrobe or chest of drawers for years. The flower petals are used for a variety of purposes. The hips are, or rather, used to be eaten as fruit, and the seeds were formerly employed as medicine for purifying the blood. The *Swamp Rose* (R. carolina), Michx., *Prairie Rose*

(R. setigera), and *Sweet Briar* (Rosa rubigenous), all bearing hips, grow wild in North America. *R. Damascena*, *White*, *Provence* (R. centifolia), *Japan Rose* (R. multiflora), *Ayrshire Rose* (R. arvensis), etc. etc., are all cultivated in gardens, and brought to great perfection.* ♄.

The *White Thorn*, *English Hawthorn* (Cratægus oxyacantha) is a bush with rugged branches, armed with sharp, tapering thorns half an inch in length. Leaves incised, wide and variously lobed; fruit, or pome, fleshy or somewhat mealy, containing from one to five bony, one-seeded carpels. Grows wild, but is often planted in hedges to enclose fields. The wood is used in Europe for making whip-handles. ♄.

The *Medlar* (Mespilus germanica) is a thorny shrub, or rather low tree, with oblong, lanceolate leaves; downy or pilous on under surface; flowers single and solitary, appearing in April or May; fruit globular, brown, with one hard seed, is pleasant to the taste, but so astringent that it can not be eaten when freshly gathered, but must be left to mellow. Belongs to the Cratageii or thorn family mentioned in Shakespeare. ♄.

The *Mountain Ash* or *Bird Berry*, *Rowan Tree* (Sorbus aucuparia), De Cand., an ornamental tree, from twenty to thirty feet in height; leaves smooth, pointed, and serrate or notched; buds round and covered with down. Cultivated for its ornamental clusters of scarlet berries. Only valuable for its beauty, as the malic acid contained in the berries renders them uneatable, although in Europe they are distilled into a kind of brandy and

* This beautiful genus includes, according to late naturalists, one hundred and forty-six species, but the varieties produced by cultivation amount to near two thousand.

vinegar. Thrushes feed greedily upon the fruit. The hard wood is esteemed in some departments of cabinet work. ♄.

The *Apple Tree* (Pyrus malus) has oblong, abruptly-acuminate leaves, mostly downy on under surface; stem fifteen to twenty-five feet high; branches geniculate; fruit depressed, globous or oblong, umbilicate at base. Branches and twigs spreading towards the top from a broad, bushy crown. Brought originally from Middle Asia, but now grows wild in Germany and other parts of Europe so abundantly that it is reckoned as native. The Romans, according to Pliny, cultivated twenty-two varieties, but there are now, it is said, one thousand varieties, if not more, raised in the United States. The *Wild* or *Common Crab Apple*, native of the Middle States, although rough, hard, and sour, so as to be altogether uneatable—the common ancestor of the present race—is now becoming scarce in the old settlements of Pennsylvania. In former times the ripe fruit was much sought after, as it was much used for preserves. Its loss, however, is more than made up for by the excellence of the present race. The apple, conducing in so many various ways to the nutriment and comfort of man, may be considered as being not among the least of the many gifts bestowed so liberally by the Beneficent Creator. ♄.

The *Common Pear* (Pyrus communis), Linn., Endl. Branches more erect than those of the apple tree; leaves smooth, notched, and oblong. In a wild state, found armed with thorns, which are lost when the tree is cultivated. Found wild in the forests of Europe, but has been known and planted in gardens from the earliest times. The Romans had twenty-two varieties (Pliny).

The French excel in the culture of the pear. The fruit is sweeter than that of the apple; it is esteemed equal with the apple for usefulness, and in one respect superior. Being more juicy and containing more sugar, it is used for making the wine called Perry; nevertheless, although the flavor is superior to that of cider made from the juice of the apple, the wine does not keep near so well. The wood is used by cabinet makers and turners. ½.

The *Quince Tree* (Pyrus cydonia), Tourne. Named for Cydonia, a town in the island of Crete, whence it was brought and transplanted in Europe. Leaves oval; under surface downy; flowers white, tinged with purple, stand singly at the end of the short twigs; fruit large, lengthened at base, clothed with a soft down or wool, yellow when ripe; resembles a pear more than an apple. It is very rough to the taste, hard and astringent when eaten raw; the odor is extremely pleasant, and as the fruit loses all its harshness when boiled, quinces are much estesmed for jellies and preserves. The seeds are enclosed in a mucilaginous envelope, which dissolves readily in warm water. This mucilage is used in many ways, and considered equal to Gum Arabic. ½.

Twenty-Eighth Family.—Pomegranate Punica, so called from Carthage, where it was first transplanted. Fruit many-celled; leaves deciduous, without the marginal vein.

Pomegranate (P. Granatum), arborescent; leaves lanceolate, standing opposite, smooth, entire; flowers on short foot-stalks, are scarlet, large, and make a fine appearance; the fruit, about the size and form of a large apple, is highly ornamental and of a fine flavor. The rind hard and leather-like, serves to protect numerous seeds, which, of oblong shape, red and glossy, sometimes

number one hundred, are about the size of grains of wheat, and lie embedded in a rich, juicy pulp, somewhat acid, but of fine flavor. In a wild state the pomegranate is only a shrub, but under culture becomes a tree, often twenty feet in height. Originally native of the East Indies, Persia, and Lesser Asia, transplanted thence to south of Europe. The taste of the fruit is pleasant, sub-acid, and cooling, like that of the currant. Both the rind of the fruit and bark of the root are considered as an excellent vermifuge.

Dwarf Pomegranate (P. nana), shrubby; leaves lanceolate, acute. Native of West Indies, where it is used as a hedge plant. Four to six feet high; flowers purple, smaller than the foregoing, often double.

TWENTY-NINTH FAMILY. — MYRTACEÆ. — MYRTLE BLOOMS.—First of this race is

The *Clove* or *Nail Tree* (Caryophyllus aromaticus). A beautiful, ornamental tree, about thirty feet high; in shape resembles the bay tree; the leaves, however, are rather smaller. The branches are four-cornered, instead of round; flowers reddish-white; the fruit, divided into two compartments, contains about forty seeds, each over an inch in length; color dark brown. Every part of the plant is highly aromatic; the buds taken off before blooming and dried are the well known cloves of commerce; they are pulled while green, and dried by smoke or heat, which turns them brown.

The *Clove* (*clou*, Fr., a nail) is in common use, everywhere known as a favorite spice, and useful in medicine, as it yields a pungent volatile oil.

The *Melalcuca Cajiputi* and *Eucalyptus resinifera*, natives of India, belong also to the family of Myrtaceæ. Cajeput oil is obtained from the first, Gum Kino from

the second. These valuable trees abound in the Molucca Islands, but are found both in the East and West Indies. ♄.

The *Common Myrtle* (Myrthis communis), Tourne. Leaves oblong, ovate, shining, with a marginal vein; flowers white; the whole shrub prized for its elegance of form and evergreen fragrant leaves and blossoms. It was sacred to Venus, and the brows of bloodless victors were adorned with myrtle-wreaths. At Athens it was an emblem of civic authority. It grows as a shrub to a height of six feet, seldom higher; bears a dark blue berry, resembling that of the Juniper tree. There is a species in Syria, cultivated for the sake of the fruit, which, about as large as a cherry, is red or white, and of a pleasant flavor. A myrtle crown is an indispensable ornament of a bride in the countries where the shrub is native. Found everywhere in places bordered by the Mediterranean. ♄.

The *Pimento* or *Allspice* (Myrthus pimenta), has oblong, shining, leather-like leaves; flowers small and insignificant; bears dark-hued berries, something larger than those of the Juniper, of pungent, aromatic taste. Grows in the East Indies, a large tree, thirty feet high. The berries, known as allspice, are used everywhere. Yield a pungent, aromatic oil, useful for many purposes. ♄.

Carolina Allspice or *Sweet-scented Shrub* belongs to the Melastoma or myrtle-like plants. Fruit, like a rose hip, but dry when ripe, and larger, enclosing the large achenia.

The *Guava* (Psidium pyriferum) grows in the West Indies, and cultivated in other tropical countries, is about the size of a common apple tree; bark hard and smooth;

leaves elliptical and somewhat curled; flowers inodorous and resemble those of the apple; fruit about the size of a common pear; rind, yellowish-green and leather-like, encloses reddish-colored pulp of pleasant taste, not unlike a mixture of raspberries, strawberries, and sugar; contains also a number of seeds. The celebrated Guava jelly is made from it.

The *Cajeput Tree* (Melaleuca leucadendron). The leaves of this tree are lanceolate, acute, and many-veined. The flowers stand in spikes or ears like corn. Height of tree often sixty feet; bark white. The flowers are white; odor sourish, but pleasant; fruit about as large as peas, contain very minute seeds. The lower part of the trunk being black while the upper is white, this tree has therefore received the name of *Melaleuca* (Greek, black-white). From the fruit and leaves an essential oil, known as Cajeput oil, used in medicine, is obtained. Fruit, flowers, leaves—in short, the whole tree yields a peculiarly pleasant odor. ♄.

THIRTIETH FAMILY.—CUCURBITACEÆ.—SICYOS, the ancient name of the Cucumber.

The *Briony* (Bryonia alba) has heart-shaped palmate, five-lobed leaves, which are notched, rough, and callous; the flowers, white, and not longer than the calyx or cup, are separated into different sexes; grows everywhere on hedges. Root thick, white, fleshy, and full of warty excrescences, contains an acrid juice used as a purgative, likewise a considerable amount of starch. The root, although full of sap in the summer season, becomes hard and woody in the winter. ♃.

The *Gherkin* or *Garden Cucumber* (Cucumis sativus), L., leaves heart-shaped, five-cornered, and toothed; stem rough, hairy, soft, and trailing; flowers yellow;

fruit cylindrical, covered with bristle-pointed protuberances; when unripe, greenish-yellow; ripe, gold color. The cucumber came originally from the East Indies, but now cultivated everywhere, and is prized as an article of table diet, particularly in the form of pickles. The seeds are said to be used in Europe for the preparation of a cooling drink, but in the United States are never employed in the same way. Vines creep to a great distance over the earth, fastening their tendrils to whatever object is near, they will climb to a considerable height. There are many varieties. ⊙.

The *Canteleupe* or *Musk Melon* (Cucumis melo), in growth and appearance of vine, bears much resembance to the common cucumber. The leaves are roundish or orbicular, with two or three abrupt angles, and heart-shaped; fruit oval or round, and often from four to six inches in diameter; has a pleasant aromatic odor; rind often longitudinally ridged; the flesh, when mature, yellowish, succulent, and of a saccharine spicy flavor, almost melting on the tongue. Originally a native of Kalmuck, Tartary, it is now largely cultivated in Southern Europe and the United States. Varieties numerous.

The *Water Melon* (Citrullus vulgaris) resembles the foregoing. Fruit ten to twenty inches long, with an oblong, firm, fleshy rind, and when mature, has a sweet, tender, watery, frosty-looking pulp of a red or flesh color; seeds black or purplish-brown. Much prized in all warm countries for the refreshment it affords. The juice, sweet and cooling, is recommended as being very salutary, and particularly wholesome. Another plant, nearly allied, often seen in gardens, which bears a different fruit, known by the name of *Citron Melon*, has a tough, firm rind, which is used for making preserves.

The whole aspect of the plant and external appearance of the fruit so closely resemble the above-mentioned, that it is supposed to be nothing more than a variety—perhaps *Var. Pastera* of Seringe and De Cand.

Colocynth (Cucumis colocynthis) has a slender, hairy, prostrate stem; leaves heart-shaped, oblong, smooth; under side covered with coarse white down; fruit globous, yellow when ripe; flowers also yellow. A native of Japan. Flesh white, dry, and intolerably bitter. The extract is the colocynth of the shops, poisonous, but medicinal. ⊙.

Prickly Cucumber (C. Anguria) is about the size of a hen's egg, covered with prickles. Native of Jamaica; cultivated for the green fruit, used only for pickles. ⊙.

Cucurbita, the Latinized Celtic name for a gourd.

The *Pumpkin* (Cucurbita pepo) has leaves rough, heart-shaped, blunt, notched, and five-lobed; fruit very large, smooth, yellow; flowers yellow. Native of the East, but now cultivated everywhere as food for cattle. The fruit, which is sometimes used as a kitchen vegetable, contains a great number of white seeds. There are many varieties, known as *Bottle Gourd, Giant Pumpkin*, etc., the latter very large. ⊙.

Flat Squash (C. Melopepo), leaves hairy; stem procumbent; fruit depressed or flat, sometimes smooth, at others warty. Cultivated for its fruit, a well known kitchen vegetable. ⊙.

Crooked Necked or *Warted Squash* (Cucurbita verrucasa), leaves, stem, flowers, resemble the above; long neck curved, thick at base. Common in gardens, with numerous well known varieties. Mentioned by Nuttale, as cultivated by the Indians west of the Mississippi. ⊙.

THIRTY-FIRST FAMILY.—GROSSULACEÆ.—CURRANTS.

—Shrubs either unarmed or spiny; bearing berries; known as currants and gooseberries. Natives of North temperate zone.

The *Red Currant* (Ribes rubrum). This shrub has five-lobed, blunt leaves; flower flat, hanging in clusters, bearing round red berries of an acid, but pleasant taste.

The *White Currant* is a variety of the red; larger and sweeter. Grows and thrives well in shady places, wherefore it is often planted in hedges. A handsome shrub, common in southern latitudes in woods and hedges. A very pleasant wine is made from the expressed juice, which latter, boiled with sugar into jelly, is considered very suitable to be used in fevers. ♄.

The *Black Currant* (Ribes nigrum). Leaves five-lobed, sprinkled on both sides with yellowish, resinous dots; grows in shady woods, on the margin of brooks; often planted in gardens. The fruit and berries have a peculiar odor that is not pleasant to some persons; nevertheless, the juice makes good wine. ♄.

The *Gooseberry* (Ribes grossularia), De Cand., *Varsativum.* This well known bush has leaves obtusely rounded, three and five-lobed; from two to four feet high; branches very thorny. Fruit a white or red berry as large as a hazel-nut, or even larger; pulpy, and filled with small seeds. Eaten as fruit, or prepared in preserves or pastries for the table. Much cultivated in England, where wine is made from the juice. ♄.

Cactacea. The Cactus family succeeds the Ribes, according to the regular order, and are distinguished particularly by having no stem on which the leaves are sustained, but the latter, hard, fleshy and prickly, grow out from each other; and thus, when the leaves are strong enough, form an upright shrub; if the contrary,

is a procumbent and creeping plant. Most of this genus have tufts of fine spines, which are easily broken. The flowers of many are very beautiful; a few, highly fragrant, grow out from the leaf-like stalks, or come forth from the edge of the joints, and are succeeded by a smooth, crimson, fig-like, eatable fruit.

The cactacea are natives of South America, where they often form a thicket which none can penetrate without receiving severe injury. Transplanted thence to Europe, where they are much esteemed, as they thrive without costing any trouble.

The principal specimen of the race is

The *Indian Fig* (Cactus opuntia), which has mostly an upright stem; sometimes procumbent, and formed of the thick, fleshy oval leaves, from which protrude tufts of innumerable fine prickles. When old, the color is brown. The flowers, rather insignificant, are yellow, and the red, fig-like fruit has an insipid, sweetish taste. ⊙.

Cereus.—Great Flowering Cactus (Cactus grandiflorus), De Cand., Linn. Stems cylindrical or prismatic, branching; the angles not very prominent, on which are placed clusters of five or six wool-like bristles; flowers large, beautiful, and snow-white; calyx gold color, and very long stamens. Expands in the evening, endures throughout the night, and fades in the morning. The expansion is so rapid that the soft trembling of the petals (ninety in number) can be seen. Fruit eatable, slightly acid, reddish-yellow, and about the size of a goose egg. ♃.

The *Snake Cactus* (Cactus flagelliformis), Lin., consists of a number of stalks, slender, cylindrical, about the size of the little finger. Indistinctly articulated—

creeping, and full of fine thorns. Bears beautiful bright pink flowers. Often cultivated, both in Europe and America. Blooms readily. 2ℓ.

THIRTY-SECOND FAMILY.—UMBELLIFERÆ. — Plants belonging to this large family generally grow high; found almost everywhere; spring up spontaneously in meadows, fields, and woods. Flowers peculiar, consisting of numerous flowerets, so arranged as to form clusters resembling an umbrella; as, for instance, in the *Millefoil* and *Carrot*. Stems for the most part hollow; leaves plumous or feather-like; root of most of the umbelliferæ spindle-shaped, fleshy, often sweet and eatable, as the carrot, celery, etc. Many, as the caraway, aniseed, and fennel, contain a volatile oil, which is extracted from the seeds.

The *Chervil* (Scandix cerefolium). Stem jointed, smooth, towards the top downy; leaves feathery or bipinnatifid (as in the carrot), leaflets or segments oval, and many-cleft (multifid). Grows in fields and gardens in the south; the tender, pale green leaves have a pleasant aromatic odor when rubbed between the fingers; therefore often used in soup. Considered very wholesome. Seeds black. ⊙.

The *Carrot* (Daucus carota), Tourn. Has a rough pale green stem; leaves two to three, pinnatifidly dissected, feathery; segments many-cleft. Grows to a height of three feet; root long, spindle-shaped, is about two inches in circumference, yellow, and fleshy. Contains much sugar; used as a vegetable; sometimes, cut in small pieces, is dried, roasted, and used as a substitute for coffee. Considered very wholesome, especially for children, as it is an excellent vermifuge; grows wild in fields and pasture lands. ⊙.

The *Parsnep* (Pastinaca sativa), Tourn. Stem furrowed (sulcate); leaves, shining smooth above; segments many-cleft; under surface downy. About three feet high; grows wild in fields and waste places; root long and thin in the wild state; cultivated, is fleshy, white, sweet, and more than a foot long. Has a sweet, spicy flavor; esteemed as an excellent vegetable; is often used in soup. Seeds flat and oval. ♂.

Dill (Anetum graveolens). Stalk naked and quill-shaped; leaves blue-green, feathery (plumous) and many-cleft; flowers bell-shaped, but rather flat. Seeds, greenish-brown, two and a half lines long; taste and odor highly aromatic, but not altogether agreeable; native of Egypt, but cultivated in Europe. Used in pickles, or for flavoring various dishes. ☉.

The *Fennel* (Feniculum vulgare). Stem naked, four to six feet high, strongly fluted or grooved; leaves, three or more, plumous (filiform), many-cleft, blue-green, and smooth; flowers large umbels; root yellow, and fleshy, like the carrot. Fruit three lines long, is grayish, with brownish stripes. The whole plant is highly aromatic; seeds sweet and spicy, are used as medicine in dyspepsia; by some for flavoring many preparations. The *F. dulce* or *Sweet Fennel*, native of Italy, on account of its succulent root and lower leaves, is used in cookery; considered wholesome and refreshing food. ♃.

Asafœtida (Ferula asafœtida) has a roundish, blue-gray stem; leaves trifoliate and compressed; root large, perennial, resembling a parsnep; black outside, but white within. Height about nine feet; seeds smooth and brown. Native of Persia, where it is cultivated in the fields; found also in Syria, Mesopotamia and China.

The whole plant, but especially the root, contains a penetrative, subtile juice or gum, which smells like garlic, and is used, with us, as medicine, but in the East for various purposes. To collect the roots being considered an object of some importance, those whose business it is proceed as follows. A party, provided with hooks, go forth and remove the earth from the roots, leaving them bare, break off the stem, and lay it with the leaves, over the roots, and press all down with a stone. In a fortnight they return, in order to collect the sap, which, the roots having now no leaves to nourish, exudes from the upper end where it was broken. The upper part of the root is now cut off, the rich, white, cream-like sap flowing freely, is carefully gathered in an earthen vessel: when it ceases to flow any longer, the remaining portion of the root is covered as before, until a further quantity of sap shall arise. The odor of the fresh juice is so powerful that one drachm of it is stronger than a hundred weight of the dry gum. As the sap dries away, it thickens, and becomes of a reddish-yellow color; is considered a valuable drug, and much used in medicine, especially in such cases where garlic would be employed. The ancient Romans were well acquainted with it by the name of *Sylphium;* used it for seasoning various cookeries, in preference to garlic. Known also in the early days as medicine, and in the present considered a specific in nervous diseases.

The *Spotted Cowbane* or *Water Hemlock* (Conium maculatum), belongs in this place, but is described elsewhere. See *Poisonous Plants* (Cryptogamiæ), Class 24, L.

Parsley (Apium petroselium) has a smooth, angular,

branching stem; leaves shining green; the lower ones much dissected; flowers umbellate and greenish-yellow or white. Grows wild in Sardinia; cultivated in Northern Europe and the United States in gardens. The root and leaves are used to season various soups and dishes for table use. A decoction of the seeds is considered a specific in some diseases, and is also used as a wash to expel vermin. ♂.

Celery (Apium graveolens). The whole plant is nearly bare of leaves; stem or branches erect, forked, many springing from the root; leaves few and much dissected; occasionally found growing wild, beside ditches, in marshy grounds, or salt licks. Flowers greenish-white, small, and hanging in numerous umbels. The root, when cultivated in gardens, is round, about the thickness of a small wrist, fleshy; the stem four feet high. The peticles or stalks, when blanched become succulent and tender, and are much valued as a favorite salad. The taste is aromatic, and imparts a pleasant flavor to soup, etc. Considered as a useful medicament in some diseases. Another variety, *Turnip Rooted Celery* (Rapaceum), De Cand., is cultivated by amateurs. ♂.

The *Common Caraway* (Carum carvi) has an erect, angular, deeply furrowed stem about two feet high, and branching from the ground; leaves large, pinnate, feathered; root small, fleshy, and as thick as a little finger. Found frequently in meadows, pasture-fields, and fence-rows. Planted in gardens, the root is larger, and the aromatic flavor of the whole plant improved by culture. The seed is the most valuable part, from its peculiar spicy odor, and pungent, but pleasing bitter taste. Contains a volatile oil, used in medicine as a carminative.

Cultivated for its aromatic properties, and fruit so well known in domestic economy. ♂.

Bibernell (Pimpinella saxifraga). Black, terete (columnar), and fluted. Leaves multified (many-cleft). Abounds in Europe; grows on dry hills, and among rocks in borders of shady woods. The odor of the root is pungent, aromatic, and disagreeable, but tastes sweet and spicy. Considered useful in relieving dyspepsia; the leaves are used as salad. 2ℓ.

The *Anise* (Pimpinella anisum). Stem resembles that of the above described. The radical leaves roundish, heart-shaped; the others three-cleft. Found wild in Egypt and the Isle of Chios; cultivated in Europe and America. Flower umbels shallow, nearly flat. The seed a line and a half in length, has a sweet and highly aromatic taste, and contains a volatile oil which is useful in dyspepsia, and forms a prominent ingredient in all carminatives. Also used in domestic economy. The oil is said to be poisonous to pigeons. ⊙.

Coriander (Coriandrum sativum) has a columnar, smooth, naked stem, branching only towards the top; leaves feathery and much dissected; flowers, umbels, flat, sustained on long pedicels. Grows in Southern Europe as a weed; nevertheless in the north and United States it is often cultivated. The whole plant has the odor of the *Cimex* or bedbug, whence the name given it by the Greeks *Koris*, a bug. Nevertheless the ripe seeds have a pleasant, aromatic taste, and are used as spice and a nucleus for sugar plums. Notwithstanding the offensive odor of the fresh herb, Professor De Candolles states that the Tartars prepare a favorite pottage from it. Considered to possess considerable medical properties as a carminative. ⊙.

THIRTY-THIRD FAMILY.—CAPRIFOLEACEÆ. — HONEYSUCKLES.—Shrubs or rarely herbaceous, with round branches, sometimes twining, sometimes slightly knobbed. Flowers axillary; do not bloom in regularly arranged umbels, but in terminal verticils or whorls. Fruit, a berry. The first representative of this genus is

The *Garden* or *Chinese Honeysuckle* (Lonicera caprifolium), a twining shrub; stem ten to fifteen feet long; branching, upper branches often hairy. Leaves connate, or perfoliate, flowers verticillate, or arranged around the stem at the axil of the leaf, with tubes tapering at the base, resembling a *Cornucopia*. Berries, at maturity, reddish-orange. Honeysuckles, with their beautiful flowers, varied, white, yellow, and pink, together with the delightful odor they send forth, have always been favorite plants for decorating arbors and porticoes, and are much frequented by humming-birds on account of the honey they contain. Several varieties American Woodbine grows wild; Lon. Grata (Evergreen Honeysuckle), Lon. Sempervirens (Trumpet Honeysuckle), etc. ♄.

The *Elder Bush* (Sambucus nigra). A high shrub, with leaves downy and in pairs, usually three and an odd one. Grows everywhere in shady places, along hedge-rows and fences; rather troublesome. Branches filled with soft white pith. The greener portion of this shrub, rubbed between the fingers, has an unpleasant odor, which, inhaled to any extent, produces dizziness; taste, pungent and bitter. Nevertheless it is a useful plant; the leaves are employed in poultices to disperse swelling; a decoction of the flowers, fresh or dried, proves a powerful sudorific, and wine is made from the juice of the black berries. The berries themselves are

also boiled with sugar into jam, which is used in sickness to produce perspiration. ♂.

The *Dwarf Elder* (Sambucus ebulus). More of a plant than a shrub; has an erect warty stem; leaves dissected, feathery; flowers reddish-white. The whole plant has a most unpleasant odor, and on this account is useful in driving away mice and other vermin equally annoying. ♂.

The *Snow Ball—Guelder Rose* (Viburnum opulus), is a large bush found wild in the woods, or by the sides of brooks in Europe, although, being ornamental, often cultivated in gardens. Leaves three or five lobed, pointed and toothed; flowers snow-white, and arranged in spheres or orbicular clusters; branches filled with pith; berries red, sharp, and bitter; sought after by birds. ♄.

The *High Cranberry* (V. Oxycoccus Americana) also belongs to this genus. Fruit red, acid; ripens late, remaining on the bush after the leaves have fallen, resembles the common cranberry; sometimes substituted for it. ♄.

The *Water Elder* (Viburnum lantana), *Hobble Bush*, American *Wayfaring Tree*. Leaves oval, unequally notched, and, together with the stalks and branchlets, covered with a ferruginous down. Berries oblong; in summer, first yellow, then red; in September black and mealy: taste disagreeably sweet, and harsh; considered good in dysentery. The small twigs, hollowed out, are made into stems for Turkish pipes.

Thirty-fourth Family. — Loranthaceæ. — Are shrubby plants with knotted or tubercled stems, rooting firmly as parasites upon other trees, and living upon their juices.

The *Mistletoe* (Viscum album). Stem forked and

branching; leaves blunt, obtuse above, ovate; flowers yellowish-green, sit closely; four or five on short, axillary spikes upon the summit of the branch; berries white, globular, and filled with a gum-like, viscid pulp. The root of this parasite is so firmly inserted through the bark into the wood of the tree, that when the trunk is sawed through, the place of conjunction can not be distinguished. The berries are a favorite food with birds particularly thrushes, and, on account of their viscous or glue-like pulp, together with the whole plant, are used for making bird-lime. ♄.

THIRTY-FIFTH FAMILY.—CORNACEÆ.—CORNELS.—Cornus, Tourne., Endl. Chiefly small trees and shrubs. The species best known in the United States is

The *Dogwood—Flowering Cornus*—(Cornus mascula), a small tree, or large shrub, with numerous smooth branches; leaves oval and pointed. Blooms very early in spring. Flowers, yellowish-white, hang in terminal capitate clusters; corolla, greenish or red. Fruit oblong; when ripe, red and glassy; seed solitary, also oblong; pendulous; has a subacid taste, and is eaten fresh or preserved.

THIRTY-SIXTH FAMILY. — RUBIACEÆ. — MADDERWORTS.—Herbs, shrubs, or trees. Contains many varieties of most valuable plants.

The *Wood-Warden* (Asperula odorata), likely *Sweet-Scented Bed Straw* (Gallium trifolium), of Michx., has a smooth, erect stalk; leaves oval-lanceolate; blooms in white tufts or tassels; fruit covered with hooked prickles; native of Europe; about one foot high; grows in cleared spots or on wooded hills; odor very fragrant; taste somewhat bitter; used in the preparation of medicated wine (hippocras). ♃.

The *Coffee plant*, *Peruvian bark*, *Cinchona*, *Carolina Pink*, *Cape Jessamine*, etc., all belong to this family.

Madder (Rubia tinctorum). Stem herbaceous, or plant-like, procumbent, lying on the ground, angular, diffusely branching, and furnished with short prickles; leaves lanceolate, arranged in verticils or horizontal rings (whorls); flowers yellow. Brought originally from the East, it is, at the present day, cultivated both in Europe and America, for the sake of the large reddish-brown roots, which are well known to yield a valuable red coloring matter, which is much used by dyers, and never fades. This sap of the roots, or the plant itself, is so penetrating, that if animals—cows, for instance—are fed upon it, the milk, skin, and even bones, become tinged with a red color. Has a musty odor; taste, a kind of bitterish sweet. Considered highly medicinal, it is used in many diseases. 2ℓ.

The *Coffee Shrub* (Coffea arabica), Willd., or rather tree, has smooth, acuminate, lanceolate leaves; flowers white, five-cleft; general appearance like that of the *Dogwood*. Berries two-celled, oval-globular; when fully ripe dark red; each cell containing one seed, which is the well-known coffee bean. Blooms nearly throughout the year. Native of Arabia Felix and Ethiopia; transplanted thence to East and West Indies. Although the Coffee tree, in the South, or in its native land, often reaches to a height of twenty feet, in Europe, even where carefully nursed in conservatories, it never attains to more than five feet. There are various modes of gathering the berries. On many plantations they cut off the branches, and strip them of the fruit, thus rendering the harvesting more expeditious. But as the berries are not all equally

ripe, the quality of the coffee obtained from the berries thus collected is considered inferior to the other methods involving more labor. Others, as in Arabia, never gather the coffee-berries until they readily fall off on shaking the tree; this crop, being fully matured, is greatly preferable to the other. The fruit, which, in color and shape, resembles that of the cornel tree, contains two seeds enclosed each in a cell containing a white, fleshy, sweetish, somewhat gelatinous pulp. In order to clear the coffee-berries from the outer skin and pulp, they are placed in heaps and covered with leaves, in order to undergo a slight fermentation, which, softening the hulls, renders them easy of removal. This completed, the coffee is put in the sun or air to dry, and afterwards, as a small portion of the husk still remains, it is carried to the peeling or winnowing mills; or, as there are many planters who have no mills, the coffee is beaten in large wooden mortars or troughs, where it is totally divested of its coats and impurities, the broken and bad grains picked out, etc., after which, it is fit for market. The soil, climate, and method of curing the coffee have a great effect on its quality. The Mocha, Surinam, and Java coffee are considered the best. The use of this luxury has been common in the East for three centuries and a half; known in Europe for two hundred years—not, however, generally. To prepare this much esteemed beverage, the berries are first roasted, then ground in a mill, and afterwards boiled. Coffee exerts a great influence on the nervous system. It enlivens the spirits, assists digestion, and relieves headache; but in delicate habits, if taken too strong, it occasions watchfulness, tremors, and aggravates many of those complaints which are denominated nervous. Persons, therefore, of high

nervous temperament should be careful not to use it to excess. ♄.

The *Fever* or *Peruvian Bark* (Cinchona officinalis) is the product of an evergreen tree, eighteen feet in height and two in circumference. Leaves lanceolate-oval, smooth and shining; flowers are pale red; the fruit enclosed in an oval capsule. The bark, rugged and of an ash-gray color, contains a yellow, intensely bitter sap, which is most efficacious in the cure of fevers, and much esteemed in medicine. Quinine, the chemically prepared extract of this bark, is considered a specific in intermittents. There are many varieties and relative genera. ♄.

Evergreen herbs, smooth, creeping, with opposite leaves. *Button Weed, Partridge Berry* (M. repens), etc.

THIRTY-SEVENTH FAMILY.—VALERIANACEÆ.—(Class 3, Linn.)

Common Valerian (Valeriana officinalis). Stem erect, furrowed, naked, and branching; leaves pinnately divided; blooms in panicles; grows in woodlands, pasture-fields, or beside ditches. The root is short and fibrous; odor aromatic, but unpleasant; taste bitter. Cats are so fond of this plant that, on meeting with it, they roll themselves over and over upon it in a kind of intoxication. The root is used to relieve cramp. The extract of valerian is recommended in nervous affections. ♃.

Pawnee Lettuce—Field Valerian—(Valeriana olitoria). Stem forked; leaves obtuse-lanceolate; flowers bluish. Grows in fields, alluvial grounds, or in vineyards. Radical leaves are used as food, dressed as salad, or otherwise cooked. Sometimes called Lamb-lettuce. Oregon Indians cook and eat it. ☉.

Nearly related to this race is

The *Scabius* or *Mourning Bride* (Scabiosa arvensis).

Stem bristly, leaves cleft and feathery, pinnatifid; heads of flowers dense, cylindrical, and of a beautiful dark purple. Found wild in old fields, but, on account of its beauty, cultivated in gardens.

Teaselworts—Fuller's Thistle or *Teasel* (Dipsacus fullonum). Stem erect, furrowed, prickly; leaves oblong, lanceolate, serrate, notched. Flowers whitish, sometimes red, in large oval or ovoid heads; grows wild, but are also cultivated for the use of the clothiers—*fullonum*—who employ the heads, with their hard hooked scales, to raise the nap upon woolen cloths. For this purpose they are placed on a revolving drum. In rich soils grows to a height of five feet, but is very brittle. ♂.

THIRTY-EIGHTH FAMILY. — COMPOSITÆ. — ASTERWORTS.*—The most extensive and most natural of all the orders of the vegetable kingdom, is always distinguished at sight by its capitate flowers, and the united anthers. Flowers collected into a *dense head* composed of many florets, perfect or imperfect, on a common receptacle. The flowers, with a strap-shaped, ligulate corolla, are called *rays* or *ray flowers;* the head which presents such flowers is *radiate.* Corolla either strap-

* Comprehends one thousand and five species at present known (1846), and about nine thousand species, being nearly one-ninth of all the species of flowering plants. This immense order is diffused all over the globe, but in very different proportions. The Compositæ furnish, comparatively, but few useful products. A bitter principle pervades the whole, which, combined with mucilage and resin, becomes tonic and febrifuge. Some are anthelmintics, from the prevalence of the resinous principle; a few, the Lettuce, Dandelion, Artichoke, and some others, are used for food; but the most numerous class of the Compositæ are the ornamental plants. The order abounds with the most beautiful specimens of the floral race, alike interesting to the florist, and of easy culture.—MAN. BOTANY.—*Tr.*

shaped or tubular, in the latter chiefly five-lobed, valvate in the bud; the veins bordering the margins of the buds. The tubular flowers compose the disk, and a head which has no ray flowers is said to be *discoid.*

The nineteenth Class, according to Linnæus, *Syngonesia* belongs to this order. The first according to this arrangement is

The *Dandelion*, corrupted from *Dent de Lion*, Lion's-tooth (Leontodon taraxacum). Leaves all radical or issuing from the root, clawed and toothed, recurving backwards towards the base of the leaf, runcinate. Makes its appearance in the early spring; grows in every field where there is grass; the stem or scape is round, hollow, bearing a single head of yellow (ligulate corolla) flowers. After the flower is decayed, the scape rises higher, and bears a head of perfected seed and seed-down, the airy, globular form of which, conspicuous among the grass, is well known to children, who call them witches, and take great pleasure in blowing them about, and also in making chains of the stems. The latter, smooth, round, and hollow, contain a milky juice; are very fragile. Root spindle-shaped, like the rest of the plant, is very succulent, and although bitter, is eaten either as greens or salad. Said to possess medicinal properties; is used in disease of the liver. 2*f*.

Lettuce (Lactuca sativa), *milky*, Lat. Stem two to four feet high; branches horizontal, and clothed with numerous small leaves, variable in form, but the lower ones are mostly roundish; upper, heart-shaped; heads numerous and paniculate; flowerets yellow. This plant, called *Salad*, is universally known, and has been cultivated from the earliest times. Taste somewhat bitterish,

but refreshing; many varieties; native place unknown. ☉.

Salsify—Oyster Plant (Tragopodon pratensis). Leaves long and grass-like; flowers, in some varieties, yellow; mostly violet-purple with a fuscous or greenish-brown tinge. Stem about three feet high. Root fusiform, fleshy, slightly bitter, contains a milky juice. Cultivated for the sake of the root, which, when properly cooked, has something the flavor of fried oysters. ♃.

Black Salsify—German *Schwartz Wurtzel* (Scorzonera hispanica). Stem branching; leaves long, wavy, toothed; grows wild in the south of Europe; cultivated in Germany; flowers pale yellow, and of pleasant odor. Root cylindrical, about as thick as a finger, fleshy, black without, white within; used as a vegetable, makes a palatable dish.

Chickory or *Succory* (Chicorium intybus). Stem erect, branching horizontally; heads of flowers on the sides of stem and branches, either solitary or in pairs; flowerets blue; leaves coarsely dentate. Found everywhere in Europe, in borders of fields or by road-sides. The turnip-shaped root has a bitter taste; considered to possess medicinal qualities. Frequently cut in small pieces, dried, and mixed and roasted with coffee; it is however, by no means an improvement on the latter. A near relative is the *Endiva Sativa*, used as winter salad.

The *Common Groundsel* (Senecio vulgaris), leaves dark-green, irregular; flower-heads yellow; pappus bearded or hairy. Grows everywhere as a weed, nevertheless is gathered as affording good food for parlor birds. ☉.

Arnica, Leopard's Bane (Arnica montana). Name

supposed to be corrupted from *Ptarmica.* Leaves decussate (in pairs crossing each other at right angles), longish oval; flowers large, radiate, and gold-colored; pappus clothed with rough bristles. Grows on hilly plains in Europe; found in some few localities in the United States. Considered valuable in medicine for embrocations, etc. ☉.

The *Colt's Foot* (Tussilago farfara). Shafts of flowers notched; scape scaly, provided with oblong, obtuse leaves, upper arising after the flowers are withered; radical leaves are oval, heart-shaped, angularly dentate, dark green above, covered with a cottony down below. Found in moist grounds or beside ditches. Tastes bitter, and contains a mucilaginous juice, which, when properly prepared, is considered a good expectorant. 2f.

The *Safflower*, *Bastard Saffron* (Carthemus tinctorius). Stem rather woody and smooth; leaves oval, thorny, and deeply toothed; flower yellowish-red; native of Egypt and East Indies; cultivated in Europe, occasionally in fields; requires a warm climate. Useful both for the coloring matter contained in its tubular filamentous flowers and as a nursery medicine. The small florets are pulled from the heads and carefully dried; impart a bright yellow color to water, but colors spirits of wine red. It is mixed with the garden saffron, and is used in the preparation of rouge. ☉.

The *Dahlia* or *Georgine* (Georgina variabilis). This well known and beautiful flower is a native of Mexico; brought to Europe fifty years ago. First consisted of only one set of large, single-rayed petals, surrounding a yellow disk and red; now, however, through culture the whole plant is improved; the flowers are large, very double and beautiful, sporting into innumerable varieties

of every conceivable shade of crimson, purple, red, rarely yellow, blooming from July until arrested by the frost. Dahlias are cultivated by dividing the tuberous roots. ☉.

The *Musk Thistle* (Carduus nutans) has a branching thorny stalk; leaves much dentated, clothed with hairs, and prickly; heads roundish, ovoid, spiny; florets mostly reddish-purple. Grows in old waste fields or by roadsides. The seeds form the favorite food of the Thistle Finches. 2ℓ. Also called *Canada Thistle.* Native of Europe.

The *Burdock* (Articum lappa). Stem branching, roughish; leaves heart-shaped, ovate, petiolate, cobwebby tomentose; radical ones one to two feet long and very broad; florets reddish-purple, with bluish anthers; flower heads short and spiny. The root about two feet long and proportionably thick, fleshy, slimy, and of a sweetish-bitter taste, is used in a decoction for purifying the blood. Native of Europe. Grows in waste lands, by fences, etc., and is a most troublesome weed. 2ℓ.

The *Artichoke* (Cinara scolymus). Leaves alternate, thorny, and deeply serrate; stalk two feet high, bearing purple flowers; root thick, fleshy, and somewhat bitter. The receptacle, together with the fleshy bases of the scales of the involucre, are boiled and eaten as asparagus, the tubers at the roots, used instead of potatoes. Native of all countries bordering on the Mediterranean; cultivated farther north, but requires some care and a rich soil. 2ℓ.

Sun Flower (Helianthus annuus). Leaves heart-shaped, cordate, triple-veined, denticulate, or slightly toothed; stalk often six or seven feet high; flowers single-rayed, nodding, large, and expanding; disk flowers

brown at the summit. Native of Peru; cultivated both in Europe and America for sake of the seeds (akenes), which yield a fine oil. Mice are very fond of the seeds, and are sure to find them. ☉.

Jerusalem Artichoke (Helianthus tuberosus), *i.*, *e.*, *Girasole* of the Italians; *Dwarf Sun Flower*, and corrupted into *Jerusalem*. Leaves oval and rough; flowers small; roots tuberous, afford good food for cattle. Also used as potatoes, but contain much less farina. Native of Brazil, but cultivated both in Europe and the United States. 2ℓ.

The *Cardoon* (De Candolle) is a variety, also cultivated for the thick, fleshy petioles and ribs of leaves, rendered white by blanching, after the manner practiced with celery. 2ℓ.

The *Roman Chamomile* (Anthemis nobilis, C. Officinalis). Stem diffuse, branching, shaggy, runs along the ground; leaflets or divisions linear, lanceolate, much-toothed, downy. Flower rays white; disk yellow. Has a pleasant, aromatic odor; tastes very bitter. Used as a specific in cramp. Grows in the south of Europe, but is also cultivated in gardens.

Common or *Field Chamomile* (A. arvensis) much resembles the foregoing. 2ℓ.

Yarrow (Millefolium Achillea), so named because its virtues are said to have been discovered by Achilles. Stem upright, either simple or branching towards the top. Leaves finely dissected, feathered, from whence its name Millefoil, feathery; flowers white. Grows everywhere, in pastures, fence rows, etc. The flowers have a pleasant aromatic odor, but are harsh and bitter to the taste; somewhat astringent; quite popular as a tonic. 2ℓ.

Wormwood (Artemisia absinthium). Leaves gray-

ish-green, clothed with silky down; flower-heads yellow, and nodding. Grows about four feet high among rubbish, rocks, and by road-sides. Has an aromatic odor, but the whole plant is proverbially bitter and of powerful medicinal qualities as a tonic, stomachic vermifuge, etc. ♃. *Terragon* (A. Dracunculus), used for salad, pickles, seasoning soup, *Southern Wood* (A. abrotanum), and *Mugwort* (A. vulgaris) belong to this family. Dedicated to Diana (Artemis) of the Greeks.

Pot Marigold (Calendula officinalis). Stem upright, rough-haired; leaves spatulate; flowers large, yellow. Native of Europe. Found in vineyards, but, being a handsome plant, is cultivated in gardens. Odor unpleasant; taste bitter. ☉. *Asters*, *Chrysanthemum-like Bidens*, *Spanish Needles*, *Beggarticks*, etc., belong to this race.

The *Daisy* (Bellis perennis), Tourne. Stem naked, and single flowering leaves numerous and spatulate, spreading from the root. Blooms amid grass; common in Ireland, but cultivated as a garden flower in many places. The Germans call it *Goose Flower*. ♃.

THIRTY-NINTH FAMILY.—VACCINIÆ.—(Class 8, L.)

The *Common* or *Dwarf Huckleberry* (Vaccinum myrtillis), *Sugar Blueberry* is a small shrubby plant, branches green, more or less angular; leaves oval yellowish, mostly evergreen. Flowers pale red; berries dark blue. Found everywhere in the woods of Northern Europe, Asia, and America. Resembles the box or checkerberry. Berries much admired for their sub-acid, agreeable taste, are used as fresh fruit, dried, or to color wine. Considered wholesome and medicinal. ♃.

Cranberry, *Red Billberry* (Vaccinum vitis idæa). Also a small shrub, resembling the above described.

Flowers bell-shaped—campanulate. The yellow-green leaves remain on the bush all winter. Berries larger than the largest peas; red, very sour, and although not unpleasantly so, rough to the taste, are, when prepared with sufficient sugar, much esteemed as an article of table diet; considered wholesome as possessing medicinal properties. 2f.

FORTIETH FAMILY.—ERIACEÆ.*—(Class 10, L.)

Heath (Erica vulgaris), a well known plant, that in the northern countries of the Old World covers vast tracts of wild land, and is remarkable for the beauty and variety of its flowers. It is unknown to North America, although there are many flowering plants embraced in the order Eriaceæ, to which it belongs. Its small, but innumerable red flowers, are very attractive to bees for the sake of the honey contained in their calices. It is also used as straw, the trailing stems being very suitable, and in Scotland and Ireland the plant enters largely into the manufacture of a variety of rude domestic articles. Sometimes it is made to serve for fuel. 2f. Many relative species of extreme beauty have been cultivated in British gardens, and nurtured as exotics, and from the elegance and delicacy of their tissue and colors, form the ornament of our green houses. These varieties claim New Holland and the Cape of Good Hope as their native places. There are from three to four hundred varieties.

Mountain Laurel, Rosebay (Rhododendron ferrugineum), L. Leaves smooth, oblong, green above, brown or ferruginous below; flowers funnel-form, stand

* But one or two of this family (*Heathworts*) are known in America. The true *Eriaceæ* are chiefly natives of the Cape of Good Hope. None in Asia or New Holland.—WOOD.—*Tr.*

in globous clusters; very beautiful, pale rose color or purplish, glandular, with white and yellow spots. The whole plant is highly ornamental; found in the United States in great perfection, also on the Alps. 2f. The Azalias also belong to this family.

Common Laurel, Calico Bush (Kalmia latifolio), stem three or four feet high; branches straggling and crooked; leaves dark-colored evergreen. Flowers large, white, spotted with red; found in the North of Europe and all of the Atlantic States. Kalm, from whom it is named, says the Swedes called this the *Spoon Tree*, because the Indians made spoons from its wood. Leaves narcotic and poisonous to some animals. 2f.

Rosemary wild, Thrift (Ledum palestre) is an evergreen shrub about four feet high; leaves small and brown on the under side. Grows everywhere in the north on moors or turf lands; leaves are bitter, harsh, and, it is said, if eaten, produces deafness. Flowers star-shaped, white or pink, are great favorites with bees. Though many other plants might be named in this sub-class, we will close our description of its members with

The *Benzoe* (Styrax benzoin), which has oblong, sharp-pointed leaves; flowers white, hanging in paniculate clusters; native of Sumatra and Java. A middle-sized tree; bears a woody nut-like fruit; on an incision being made in the bark, a gum exudes plentifully; has an agreeable balsamic odor, known as Benzoin, and used as a cosmetic. 2f. A relative species, the *Storax Tree*, yields the article known in the shops as Gum Storax.

Third Sub-Class.—Flowering Shrubs.

Forty-first Family.—Oleaceæ.—(Class 2, L.) —Flower-petals single, inserted on the calyx. The olive is the type of this family.

The *Common Olive* (Olea europaeæ), leaves leathery, dark above, whitish below, lanceolate and margined; flowers white, come forth in small corymbs or tufts from the wings of the leaves; growing wild it is only a shrub, cultivated it grows into a considerable sized tree. Native of Asia, but transported into Italy at a very early day; farther north is cultivated in conservatories. The fruit, half an inch in length and four lines thick, is of oblong shape, like a small plum, at first green, afterwards black; pulp rather pithy, rough and bitter, therefore they are never eaten raw. Olives are prepared for table use, by soaking them in ley-water, in which ashes have been boiled, then transferred to clear water, where they are left for some time, changing the water frequently; last of all pickled with salt and spices, are fitted for exportation. They are, however, more valued on account of the sweet oil which they yield abundantly, and which is not only important in cookery, but used for numerous other purposes. For making sweet oil it is necessary that the fruit be perfectly ripe; the oil pressed first from it cold, is, with some further preparation, the well known Provence oil. The portion first obtained, very sweet and pleasant, commands the highest price, and is called Virgin Oil, the second White Sweet Oil. The common olive oil, of a greenish-yellow color, is obtained from the fruit after being heated, and has both an unpleasant taste and odor. In those countries where the olive trees

abound, the oil is in general use, as it is not expensive. The wood makes handsome cabinet work. The olive, it is said, will live for centuries, and it is supposed that those aged trees, still found on Mount Olivet at Jerusalem, are the same under whose shadow the Saviour rested. Two of them measure twenty-five feet in circumference. In the days of mythology the olive was considered sacred, and even in the present time, the olive-branch is everywhere recognized as the emblem of friendship and peace. ♄.

The *Ash* (Fraxinus excelsior), one of the highest trees, is slender, branches marked with warts; bears handsome, light green leaves, very much indented; flowers small, in crowded panicles; buds large and dark-colored. Wood, white and hard, is much valued by coach-makers and wheel-wrights. ♄.

The *Manna Ash* (Fraxinus ornus); leaves unequally paired; leaflets accuminate, oval, lanceolate; under surface downy. Flowers greenish-yellow and of agreeable odor. Native of southern Europe, viz., Calabria. The gum, called manna, which, in the warm season exudes from the bark, is the sweet sap of the tree, dried hard by exposure to the air. The odor of this honey-like fluid is unpleasant, the taste slimy, sweet, and nauseating; it, nevertheless, possesses some valuable medicinal qualities, and is used as an aperient with children. ♄.

The *Common Lilac* or *Spanish Privet* (Syringa vulgaris), a large bush twenty feet high; leaves smooth, heart-shaped, and acuminate; flowers white or of various shades of purple, stand in dense, terminal panicles; odor very sweet. It is one of the most beautiful shrubs found in gardens; cultivated everywhere. Native of Persia. Sometimes known as *Persian Lilac.*

Privet or *Prim* (Ligustrum vulgare), a bush with leaves lanceolate, smooth, and thick. Flowers white, agreeably odorous, in clusters or terminal panicles; berries black, filled with pulp of a purplish-red color; native of Europe, found in woods and hedges. The hard wood is used by turners.

Forty-second Family.—Datura.—(Class 5, L.)

Nux Vomica (Strychnos nux vomica) is a tree of considerable size, with a thick crown of oval-shaped, bald—awnless—greenish-white leaves; flowers clustering and umbellate. Native of the East Indies, where it is often met with. Fruit contains three to four round, smooth, nut-like seeds, surrounded with a mass of pulp, which is not at all poisonous. These seeds, called Crow's Eyes, are remarkably bitter and highly poisonous. The far-famed Boa Upas Tree of Java, of which travelers have given such exaggerated accounts, belongs also to this family. They tell us of its growing in a valley, and being so fearfully poisonous that everything, whether animal or vegetable, found within a few leagues of it, is affected by its poisonous influence. As the tale goes, a poisonous gum exudes from its bark; criminals condemned to death, are sent to gather it; any one who returns from the tree unpoisoned, bringing the gum as witness of his having been there, is pardoned; this is sometimes the case when the wind is favorable, for if the poisonous breath of the tree reaches the unhappy culprit he is lost. This account of the Upas Tree, which has supplied Dr. Darwin with a highly poetical description, although now confuted, has heretofore generally been believed; nevertheless, as in most similar accounts, there is some truth present, although mixed up with much fiction. It is highly dangerous to sleep under any tree of

the Strychnos family, and altogether certain that the operative element of the Poison-tree, swallowed even in an unconsiderable quantity or received into the system through a wound or abrasion of the skin, however slight, proves deadly. Another description of Java informs us of a deep ravine found there, called the Valley of Death, in which no living thing has ever been known to exist, not, however, because of a poisonous tree, but that, through a number of fissured rock found there, supposed to communicate with some subterranean volcanoes, so great a quantity of carbonic acid gas escapes, that any one entering with the sphere of this mephitic vapor becomes asphyxiate, and is soon suffocated. Every one knows that the same danger attends the entering of a cellar where wine is fermenting. These two accounts, mixed up together, have most probably formed the foundation of the marvelous story of the Upas tree.

FORTY-THIRD FAMILY.—ASCLEPIADACEÆ. — (Class 5, L.)—Plants or shrubs with an acrid, milky, poisonous sap or juice.

Swallow Wort (Cynanchum vincetoxicum). Stem large, stout, and branching; leaves heart-shaped; flowers white, standing in clusters; grows everywhere on barren hills; height two or three feet. The root has a strong, nauseating odor; tastes sweetish at first, afterwards sharp and bitter; creates vomiting and distressing sickness. Branches whitish and warty. 2*f*.

The *Periwinkle* (Vinca minor) is a perennial evergreen plant, delighting to grow in the shade of woods, etc. Leaves oblong, lanceolate, smooth; flowers blue, single, and inodorous, have long footstalks. Also called *Running Box.* 2*f*.

The *Oleander* (Nerium oleander) is an erect ever-

green shrub, with leathery, coreaceous, slender, lanceolate leaves; flowers, pale red, have a faint odor, like that of bitter almonds. This beautiful plant has been brought us from the East Indies; delights in warmth, and requires a great deal of water. In countries bordering on the Mediterranean, it is planted on the banks of brooks. Common in Palestine, growing by rivulets; known as *Rose Bay Tree;* is commonly supposed by travelers to be the plant to which the Psalmist alludes, Ps. i. 3, and xxxvii. 35. Branches soft, and contain a milky juice. 2f.

Several other American plants, known as varieties of the Silkweed, belong to the Asclepiadaceæ.

The *Gum Elastic Tree* (Tabernæmomontana elastica) is a climbing shrub, with acuminate, oval leaves and small, greenish flowers. It mounts to the top of the highest trees. Native of Sumatra, where the inhabitants use it as gum elastic. They make incisions into the trunk, and the milky sap which follows, is collected. This fluid, dried in the sun, thickens, and forms a kind of gum elastic, much inferior, however, to the Caoutchouc, but used as such by the natives. Seldom employed in Europe.

Forty-fourth Family.—Gentianaceæ.—(Class 5, L.)—Pentandria, are mostly plants with five free stamens.

The *Yellow Gentian* (Gentiana lutea) has oval, strongly ribbed leaves; flowers yellow, rotate; arranged in verticils; grows profusely on high hills, or dry wooded places. Root thick and fleshy, has an unpleasant odor; tastes, at first, sweetish, afterwards intolerably bitter; used as a tonic in medicine. Found in Europe and America. 2f.

Buck Bean (Menyanthes trifoliata), Tourn. Leaves

on long, round foot-stalks, trifoliate or three-lobed; leaflets obovate. Grows in swamps and margins of ponds. Root about as thick as a finger, branching; descending deep into the earth. Flowers pale red, very ornamental, arranged in pyramidal clusters. Contains a bitter principle, considered actively medicinal. 2f.

FORTY-FIFTH FAMILY.—CONVOLVULACEÆ. — BIND-WEEDS.—These are plants which climb to a considerable height by twining their elastic stems around those of other plants. (Class 5, L.)

Small Bind Weed (Convolvulus arvensia). Stem contains a milky juice; leaves arrow-shaped; found in fields, vineyards, etc., as weeds. Flowers white, marked with red; the whole plant is filled with an acrid, milky sap; not poisonous and readily eaten by cattle. ☉.

Convolvulus Batatas—Sweet Potato (Batatas edulis. Choisy). Stem creeping; leaves heart-shaped, lanceolate, five-lobed; acuminate. Native of both Indies; planted everywhere in the south for the sake of the tuberous roots, which furnish nutritive and palatable food; somewhat resemble the common potato; do not contain so much farina, but a great deal of sugar; many prefer it to the *Irish Potato* (Tuberus solanum). Easily cultivated in sandy soils (New Jersey), where they yield a profitable crop.* They are planted in hills or rows, like corn, or the common potato, by dividing the tubers, leaving an eye or bud in each piece; each of these contain a germ of the plant, and send forth a root. The leaves and tender shoots are also eaten. Cultivated

* Supposed to be the same species of roots as those which Columbus's sailors were treated with by the inhabitants of Cuba. They described them as being very sweet, and, when boiled, tasting like chestnuts.—*Tr.*

in all countries lying within the south temperate zone, Southern Europe, etc. The *Jalap* of the shops is the product of the root of the *Exogonum purga* of Mexico, *Scammony* of Convol. Scammonia, native of the Levant. The drastic qualities of both depend upon the presence of a peculiar resin. 2ℓ.

FORTY-SIXTH FAMILY. — BORRAGINACEÆ. — Plants or shrubs, seldom trees—with single flowers. (Class 5, Linn.)

The *Forget-me-not* (Myosotis palustris), Germ., has a simple, angular stem—obtuse, lanceolate leaves—and handsome blue flowers, arranged in hanging clusters. This beautiful plant delights in damp grounds, or by brook sides. Remains fresh a long time after being pulled. Much prized in Europe, where it is sent to friends as a token of remembrance. *Scorpion Grass* (M. crepitosa), Schultz (a laxa), De Cand., is often mistaken for it. The latter grows in Canada and the United States. 2ℓ.

Heliotrope (Heliotropium peruvianum). A herbaceous rugous shrub. Is a native of Peru, but, on account of its elegance, cultivated as a green-house plant. Leaves rough, lanceolate, longer than wide. Flowers erect, small, but numerous, very fragrant, white, or tinged with purple. ♄.

Borage (Borago officinalis). Stem branching and hairy; leaves oblong-oval, rough, stalked, and deeply incised; flowers light-blue. Native of Palestine, but now growing wild in Europe. Leaves and stalks very succulent, and tasting like cucumbers, is eaten as salad. ☉.

Lungwort, *Hound's-tongue*, *Wild Comfrey*, etc., United States, belong also to the Borinaceæ family.

FORTY-SEVENTH FAMILY.—SOLANACEÆ.—(Class 5, Linn.)—Plants herbaceous or shrubby; many of them poisonous.

Woody Night Shade—Bitter Sweet (Solanum dulcamara). Stem shrubby and climbing; leaves heart-shaped, ovate; flowers blue, in cymous clusters; berries oval and red. Found about hedges, low grounds, and banks of rivulets in Europe, also from Arkansas to New England. The root being chewed, gives at first a sensation of bitterness, then of sweetness. Leaves and twigs have been used medicinally. ♄.

Horse Nettle (Sol. Carolinense), *Black Night Shade* (Sol. nigrum Virginicum), belong to this family.

The *Jerusalem Cherry* or *Coral Tree* (Solanum pseudo capsicum) is shrub-like; leaves lanceolate; bears white flowers. Kept in parlors or conservatories for its beauty, as its cherry-like, coral-red fruit is tasteless, and although harmless, of no possible use. Native of Madeira. ♄.

The *Common Potato* (Solanum tuberosum). Stem herbaceous, somewhat creeping; leaves interruptedly pinnate; flowers white or bluish; fruit globular, small, greenish-yellow; base and roots producing fleshy tubers containing farina. A native of Peru, the potato was unknown before the middle of the sixteenth century, when it was sent to England by Sir Francis Drake. Although he wrote a full description of the valuable qualities of this useful esculent, he forgot to remark that the tuberous portions of the root only were to be eaten. Potatoes were accordingly planted in the royal gardens, and grew well; the small, berry-like fruit ripened, and the head cook of Queen Elizabeth anticipated what great honor he should receive in the preparation of a dish of

potatoes, when it should appear on the royal table. But no art availed to make *Potato Apples* palatable. Great odium fell on Sir Francis Drake for the deception he had practiced, and orders were given for the worthless plants to be plucked up by the roots and thrown away. The gardener thought best to burn them as rubbish, and did so; but as they were burning he was attracted by the savory odor from the pile. Taking up one of the tubers he found himself constrained to taste it. *Eureka!* The treasure was found, and from that time it gradually came into use. Although at present the potato constitutes a large portion of the food of civilized man, it was, for the first two hundred years after Elizabeth's reign cultivated only for feeding swine; for great prejudice existed against the plant being used as food for man. This, however, was gradually removed; the potato is now in general use everywhere, and a favorite article of diet; is prepared in various ways as farina, sago, etc.; also distilled into brandy in Russia. ☉.

The *Egg Plant* (Solanum insanum), sometimes called *Mad Apple*, is a prickly shrub; leaves woolly and oval; flowers pendulous, bluish-red; fruit oval, egg-shaped, purple or white; sometimes very large. The white never larger than a hen's egg, and cultivated for ornament only. The purple egg-plant is used as an esculent, and much esteemed. Native of Asia and Africa. ☉.

Red or *Cayenne Pepper* (Capsicum annuum), Tourne. Stem herbaceous, angular, branching above; leaves ovate, acuminate, and on long petioles or foot-stalks. Flowers stand single; fruit or berries red, pendulous. Native of India and South America; cultivated in gardens both in southern Europe and United States. There are at least

twenty varieties, all differing in size, color, and taste. Seeds small, yellow, and flat. The whole plant is pervaded by a heating, acrid principle—considered wholesome. The best known are the Long or Cayenne; the Squash Pepper, best for pickling; the Cherry Pepper, used for pepper sauce and in seasoning meats, and the Sweet Spanish Pepper, use as a salad. ☉. Others of the Solonaceæ will be found under the head of poisonous plants, Nightshades, etc.

Forty-eighth Family.—Scrophulariaceæ.—Figworts.—Chiefly herbs with flowers, solitary, corymbiferous, often arranged pyramid-like.

Lion's Mouth, Great Snap Dragon (Antirrhinum cymbalaria), stem creeping; leaves heart-shaped, five-lobed; flowers red or pink; the lower lip white, mouth yellow, with a prominence resembling a palate at base. This pretty flower is found in Europe, climbing over old walls, which it covers with its rank luxuriance. ☉. The purple Lion's-mouth is cultivated everywhere as an ornament to gardens.

The *Common Mullein, Beard Plant* (Verbascum thapsus), stem three to six feet high, stout, simple; leaves lanceolate, pendulous, and very woolly; flowers grow on a cylindrical spike, something like ears of corn, small and bright yellow. Grows in waste grounds, rubbish heaps, etc. Considered useful; flowers prepared in an infusion which is given for a cough. ☉. *Toad Flax* (Linaria), also called *Butter and Eggs*, belongs to this family. Very abundant in Pennsylvania.

Sub-Family Bignoniaceæ.—Woody vines or trees, the first of which race is

The *Calabash Tree* (Crescentia cujete), in size and general appearance resembles the quince tree; leaves

shining green; flowers yellow, furrowed, and ventricous. Fruit of various sizes, according to the different kinds of tree; in form resembling gourds, but in structure altogether different. The rind or outer covering is tough and woody, clothed with a green skin, within this is a fleshy pulp, enclosing many seeds, but being very bitter, can not be eaten, although it is sometimes used in pulmonary cases. The rind is the only part employed for any purpose, but the natives of the West Indies and South America consider it to be of infinite use, and make a variety of domestic utensils from it. One large calabash with the neck cut off serves to hold water, another of a smaller size, cut in half, is used as a dish, in which beans and hominy are served; the fruit of another variety or the necks of the larger, form drinking cups; other segments are employed as spoons, cupping-glasses, powder-horns, etc. The Indians are careful to plant the different species of the race, and very well understand how to paint and ornament them. They manifest considerable skill in cutting various figures on the rind while it is still green, and some of these ornamented calabashes are very beautiful. Others, adorned with feathers, and each provided with a movable piece of wood which turns like a handle, are partly filled with pebbles and used in their religious ceremonies. Much attention is paid to the noise of the rattling pebbles within, being used as a species of divination to predict the future. Vessels made from the cabalash will not bear the action of heat. ♄.

The *Sesamum* or *Oily Seed* (Sesamum indicum); stem erect, four feet in height; leaves lanceolate, with petioles; thimble-shaped flowers; seeds whitish-yellow, in angular two-celled capsules. Native of East Indies.

Seeds yield an excellent oil, which will keep several years without injury. Used in cookery for all the purposes of sweet oil; also for burning, and as ingredient in salves, etc. Five pounds of seeds yield one of oil. Another species with black seeds is inferior. ☉.

The *Trumpet Flower* (Tecoma radicans), Juss., and *Catalpa* (C. Cordifolia), Jaum., natives of United States, and *Tecoma Chinensis*, native of China and Japan, are also found among the Bignoniaceæ.

The *Lianas*, found abundantly in all tropical countries and everywhere met with in the primitive forests, claim their place here. Flinging themselves in wonderful and beautiful reaches from tree to tree, they unite those forest monarchs with each other, their green bands varying in size from a slender filament up to a cable rope. Most of them are parasitic, and rooting themselves on the top of the tree, travel downwards and unite it with the earth, often, however, distorting their stems into the most grotesque convolutions on the way, sometimes assuming the shape of a gigantic cork-screw, at others the form of steps, frequently called Monkey-stairs. Many are prized for their beautiful flowers, others for their medicinal properties or excellent wood; a few, when an incision is made in the bark, pour forth cool, clear water, proving a real cordial to the wanderer in those torrid regions. Others, too, have been described as resembling the trees of the enchanted forest, sung by Tasso in Jerusalem Delivered, which, on being cut, yields a bloody sap; this, sprinkled upon the clothes of the intruder, leaves a stain which never can be washed out; the Indians use it for painting themselves. The lianas, twining thus from tree to tree form a perfect tangle, and growing large and strong, become so tough

that it requires some labor to hew them down. Nevertheless—as nothing is without its use—they are indispensably necessary to the natives in building their huts, as, having no nails, they serve in place of this article to bind the beams and posts together, and prove as strong as mortises or tenons.

FORTY-NINTH FAMILY.—LABIATÆ.—(Class 2 and 14, L.)—This well known family of plants have mostly labiate of two-lipped flowers, by which they are distinguished; partly herbaceous, partly shrubby.

The *Sage* (Salvia officinalis) has an upright, branching stem, growing in bunches; leaves oval, somewhat wrinkled or petiolate; the whole plant woolly and grayish-green; flowers bluish-purple, and arranged in whorls forming a spike. Native in the south of Europe, but planted in gardens, where it grows into a shrub. Has a balsamic odor, somewhat like that of camphor; taste bitter, aromatic, and slightly acrid. Very useful in domestic economy and medicine. ♄.

The *Rosemary* (Rosmarinus officinalis), an erect, evergreen shrub, stem much branched, younger branches angular and downy. Leaves opposite, obtuse; under surface whitish and downy; flowers in compact, terminal heads, axillary, of a bright blue color, having, like the leaves, a strong aromatic fragrance like camphor; yields by distillation a large proportion of fragrant oil. Native of southern Europe, where it grows wild among the rocks along the sea-coast; planted in gardens, is used as seasoning in cookery and also medicinally. ♄.

Peppermint (Mentha piperita) is herbaceous; leaves smooth, ovate, lanceolate, serrate, petiolate; flowers whitish, bordered with red, arranged in terminal spikes. Grows wild in England, cultivated in gardens elsewhere,

from which, however, it often strays abroad. Thrives best in wet places. Has a strong, pleasant, aromatic odor, a penetrating taste, pungent to the tongue at first, afterwards followed by a sensation of coldness. Essence of peppermint is well known as a medicine; acting as a cordial in flatulency, nausea, etc. ♄.

Spearmint (M. Viridis, M. tenuis Michx.), *Water Horehound* (L. Sinuatus), *Dittany* (Cunila, L.), *Wild Basil* (Clinopodium) are all nearly related to the genus Mentha.

Summer Savory (Saturega hortensis). Stem erect, much branched; leaves numerous, small, and narrow; under surface spotted; flowers, purplish-pink, stand in axillary cymes. Grows wild in the south of Europe; further north and in the United States planted in gardens as a culinary aromatic. In Germany eaten as a seasoning to beans. ♄.

Hyssop (Hysopus officinalis). Stem erect, branching, rough, and hairy; leaves lanceolate, acute, punctate; flowers whitish or pale pink, arranged in terminal spikes. A handsome plant, found growing wild on dry hills in the south of Europe; cultivated in gardens for its reputed medicinal properties; used as a popular febrifuge. The odor of the hyssop (Ezob of the Jews) is strongly aromatic and agreeable; taste bitter and camphor-like. ♃.

Catnip or *Catmint* (Nepeta Cataria) has an erect, woolly stalk; leaves oval, heart-shaped, crenate, or tooth-like; grows everywhere on rubbish-heaps or about old buildings and fences. Sometimes found in gardens, as it is believed to be possessed of medicinal properties. About three feet high; taste aromatic-bitter. Cats are very fond of the plant, and devour it with the greatest

avidity, rolling over it in seeming intoxication, as they do with Valerian. 2ℓ.

Lavender (Lavandula spica), stem erect and branching; leaves small, tapering to the base without petioles, crowding on the branches, which are slender and clothed with whitish down; flowers, bluish-lilac, stand in spikes. Grows wild in southern Europe, where it delights on sunny hills; cultivated as a garden plant in the north and United States on account of its delightful aromatic fragrance and herbaceous beauty; taste a pleasant, spicy bitter; is used as a stimulant and tonic, and the oil, extracted by distillation, enters into many compositions in medicine and perfumery. 2ℓ.

Sweet Marjoram (Origanum majorana), stem upright, branching from the ground; leaves obovate, obtuse, petiolate, and, like the stem, downy; flowers small and whitish-pink, cluster in short spikes on the end of the branches. Native of the south of Europe—Portugal and in the East; often cultivated in gardens. It has a pleasant aromatic flavor and is employed in various ways as a seasoning. ☉.

Garden Thyme (Thymus serpyllum). Stem creeping at base; branches small and erect; leaves petiolate, oval, obtuse; flowers purplish-pink, arranged in tufts on terminal spikes. Stem and leaves downy. The wild thyme grows on hills and uncultivated places in Europe, and is highly attractive to bees. This well known herb has a penetrating, aromatic odor, pleasantly acrid taste, is found in every well-ordered kitchen-garden. Used for culinary and medicinal purposes; considered almost a specific in rheumatism, contusions, etc. 2ℓ.

Balm (Melissa officinalis). A plant with an erect, branching stem, rough above; leaves elliptical, ovate,

petiolate, tapering to a point with whitish down beneath. Flowers ocheous white; calyx hairy, arranged in terminal whorls or heads. Grows in south of Europe on mountainous hills, but is also cultivated in gardens everywhere in Europe and the United States; known by the name of Citron Plant. Odor very fragant and citron-like; taste pleasantly aromatic, slightly pungent, and bitter. Considered medicinal, and made into tea, is useful as a stomachic and in nervous complaints. Also used as seasoning in cookery. 2f.

Ground Ivy—Ale Hoof—Gill over the Ground—(Glechoma hederacea), a creeping plant, leaves reniform, kidney-shaped, crenate; flowers axillary, three together, bluish-purple. Grows everywhere by road-sides, hedges, etc. Very troublesome in gardens. Odor slightly aromatic; taste, acerb and bitter. Considered medicinal, and formerly used in the preparation of *Hippocras* or medicated wine. 2f.

The *Dead Nettle—Henbit* (Lamium album). Leaves roundish, petiolate, and toothed; flowers purplish or white, campanulate; stand in axillary whorls. Has a sweetish, slimy taste, and faint honey-like odor. Found growing in fence-corners, hedges, etc., also in cultivated grounds. Sometimes used medicinally. 2f.

FIFTIETH FAMILY.—PRIMULACEÆ.—(Class 5, L.)

Primrose (Primula veris). Leaves radical, oval, rugate, serrate; flowers yellow, pendulous, hanging in tufts or tassels; have five bright, orange spots on the throat. Found in grass plats, hedges, dry ridges, etc. Flowers used in Europe as tea. Odor faint and unpleasant. 2f.

Scarlet Pimpurnel or *Red Chickweed* (Anagallis arvensis). Stem upright, acutely angled; leaves ovate,

pointed, black dotted beneath; flowers standing singly, orange-red or brick-dust color; grows in fallow fields and uncultivated grounds; is without odor; taste at first mawkish, afterwards bitter; injurious to cattle if eaten of largely. It has been remarked in Europe, that if the flowers are expanded in the morning the day will be fine, if shut, the contrary; hence it has been named the *Shepherd's Weatherglass.* ☉.

Next to this family come the Plantaceæ, represented only by the genus Plantago.

Common Plantain—Rib Grass (Plantago major). Leaves ovate, smooth, with from five to nine strong ribs; flowers in cylindrical spikes; grows everywhere as weeds. Seeds are useful for feeding birds. ☉.

English Plantain—Rib or *Ripple Grass* (Plantago lanceolata). Stalk grooved, angled, and slender; leaves lanceolate and toothed; spike short, thick, almost egg-shaped; flowers brownish-white. Leaves contain an acrid sap, therefore considered good for dressing wounds, blisters, etc., a fact which seems to have been known in the days of Shakspeare (*Romeo* and *Juliet*, Act i., scene 2). Also used as domestic medicine. ☉.

The *Sow Bread* (Cyclamen europæum). Radical portion of stalk fleshy; leaves heart-shaped on long foot-stalks; flowers rose-colored, dark-throated, and very fragrant. This beautiful plant grows wild in the shady woods of the southern Alps, and constitutes their chief ornament. The acrid, fleshy root is poisonous, unless roasted, after which it can be eaten with safety.

FOURTH SUB-CLASS.

APETALÆA. Flowerless plants. Flowers inclosed in a sheath. Mostly coarse, weed-like herbs; leaves alternate; flowers inconspicuous; corolla none, the floral envelopes being mostly in single series (calyx), or sometimes wanting altogether.

FIFTY-FIRST FAMILY.—CHENOPODIA.—(Linn.)

The *Common Beet* (Beta vulgaris) has a reddish, angular stem; lower leaves ovate, oblong, wavy; upper ones lanceolate. The *Sugar Beet* grows wild everywhere in the neighborhood of the Mediterranean Sea; farther north cultivated in gardens for the purpose of making sugar, and also as an esculent. The Germans prepare both root and leaves in various ways, as pickles, salads, etc.; they call it *Red Root*. The *White Beet*, *Scarcity*, or *Mangel Wurtzel* (B. cicle) is cultivated as food for cattle. The *Burgundy Beet* (Runkle rube) is much valued as a table vegetable. Both are nearly related to the *Sugar Beet*, the root of which is yellowish. The beet is said to yield sugar equal to that of the cane; but as long as the Sugar Maple and the Sugar Cane exists to supply us with that important article, it is not probable that the Beet will be much relied on. The beet sugar is said to rank next to that of the West India. ♂.

Spinnage (Spinacea oleracea). Leaves arrow-shaped; root resembles that of the white beet; flowers greenish. Brought by the Arabs into Spain, it is now in general use as a favorite vegetable. ♂.

Samphire or *Salt Wort* (Salsola kali). Stalk about one or two feet high, diffuse; leaves small, spiky; flow-

ers, green, standing singly, close to the stem. Grows on downs lying along the sea-coasts; strays sometimes a short distance inland, in good sandy soils. Found from New England to Georgia. Used, with other varieties of the species, in the preparation of *Soda*, and cultivated largely in Spain, for this sole purpose. It is first burned into ashes, from which the soda is extracted.

FIFTY-SECOND FAMILY.—POLYGONEÆ.—Herbs, rarely shrubs, with alternate leaves. (Class 6, L.)

Buckwheat (Polygonum fagopyrum). Stem erect and smooth; leaves heart-shaped, with distinct rounded lobes. Native of Middle Asia, but naturalized in Northern Europe and United States. Grows well in poor and sandy soils, or rough, hilly districts. The seed makes good *grits* or *groats;* the farinaceous albumen affords a delicious article of food in *Buckwheat Cakes*, which, when skillfully made, very few refuse. The white, glandular flowers are a favorite resort of the honey-bees, and afford a rich reward for their labors, although the honey is of inferior quality. It is a peculiar belief that white hogs can not eat buckwheat without injury; said to create a species of madness, while the black swine feed on it with impunity. ☉.

Sour or *Curled Sorrel Dock* (Rumex acetosa). Radical leaves, heart-shaped, on long petioles; flowers in crowded verticillate fascicles; color slightly red. Stem two or three feet high; grows in meadows or gardens. The radical leaves of this plant are often used as a pot-herb, early greens, or salad, both in Germany and our own country. Root and seed disagreeable and acerb. ☉.

Rhubarb (Rheum australe). A shrubby plant about five feet in height; leaves roundish and heart-shaped. Native of China and Tartary. Flowers reddish; root

fleshy, branching, and yellow, furnishes the well-known medicine of the shops. Very medicinal as brought from its native land, but, transplanted into Europe and elsewhere, deteriorates so much as to lose all its officinal qualities. It has a powerful, disagreeably aromatic odor; taste, nauseating and bitter. As the Chinese rhubarb is supposed to lose much of its medicinal quality by being transported by sea, that brought by the overland route is greatly preferable. The *Monk's Rhubarb* (Rheum rhaponticum) is the *Pie Plant* of the garden, so commonly cultivated for its acid and esculent leaf-stalks. ☉.

.Fifty-third Family. — Lauraceæ. — Aromatic Trees or Shrubs. The tropical plants of this order, some of which contain the aromatic principle in their leaves, others in the bark, are interesting.

The *Bay Laurel* (Laurus nobilis). Leaves oblong, lanceolate, leathery, veined and evergreen. Flowers hanging in umbelliferous tufts, yellowish-white; fruit or berries dark green, and egg-shaped. Found in all the countries bordering on the Mediterranean, where it is only a shrub; farther south it grows into a tree thirty feet in height. Leaves have an aromatic odor and spicy taste; contains a bitter principle, which, extracted, is considered a good stomachic. The berries yield a species of camphorated oil, which is used in medicine. The bay-laurel, famed from the earliest days of mythology, was dedicated to Apollo; conqueror and poets received a crown made of the leaves, which was considered the highest mark of distinction that could be bestowed. ♂.

The *Cinnamon Tree* (Laurus cinnamomum). Branches and leaf-stalks are naked and angular; leaves ovate, oblong, gradually tapering to a point; flowers yellowish-

white and silky, come forth in panicles Found in Ceylon, where the groves of cinnamon trees are said to be a mile in length; also in Martinique and Mauritius, whence they have been transplanted into South America; the latter is said to produce the best variety of this popular spice. Grows to a height of twenty feet; bark is gray on the outside, yellowish-red within; fruit, berries of an oblong shape. The odor of the cinnamon is uncommonly strong, and highly aromatic; taste, pleasantly spicy, but not so pungent as that of the Chinese variety. The tree which produces the latter is nearly related to the cinnamon tree of Ceylon, but more spreading, and the bark coarser and more biting, is less esteemed, and consequently much cheaper. ♄.

The *Camphor Tree* (Laurus camphora). A very ornamental tree, resembling the linden; grows in China, Japan, and Cochin China. The leaves ovate-oblong, interruptedly pinnate and B-ribbed, are green and reddish; flowers small and white, are arranged in panicles or tufts, each composed of two dozen; fruit, dark-red berries, about the size of peas. Every part of the tree, especially the root, smells and tastes of camphor. The well known gum of the shops is obtained, first, by boiling the leaves, etc., afterwards by distillation, and lastly evaporation. ♂.*

The next in order is Myristaceæ.

The *Nutmeg Tree* (Myristica moschata), plate 27, fig.

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* *Fever Bush, Spice Wood, Laurus Benzoin, Sassafras* (S. officinale), belong to the Lauraceæ. All the species are, throughout, pervaded by a warm and stimulant aromatic oil. Cassia bark is obtained from *Cinnamonum Aromatica* of China. Persea Gratissima, a tree of West Indies, yields a delicious fruit called the *Avocoda Pear*—*Wood.*—*Tr*

3. Leaves on short petioles, oblong, obtusely rounded; flowers small, pale yellow, resembling May-flowers, and of both sexes. Fruit, a berry-like plum, yellow, and about the size of an apricot. Ripens six months after the time of budding; the outer covering or hull opens like that of our hickory nuts, and a dark-colored seed or nut drops out; it is enveloped in a thin, reddish-colored skin, which is called *Mace*. The kernel contained in the nut is the genuine and well-known nutmeg. The nutmeg abounds in a warm, stimulant, and volatile oil, and is, together with mace, much used in cooking. ♄.

FIFTY-FOURTH FAMILY. — THYMELACEÆ. — DAPHNIADS.

The *Mezereum—Spurge Laurel* (Daphne mezereum), a European plant, is a small shrub; leaves lanceolate, entire, in terminal tufts; flowers handsome rose-color; some varieties white; of powerful, pleasant, but stupefying odor; fruit, berries about the size of peas, bright red. Grows in damp, shady forests; blooms about the end of February. The whole plant, the bark especially, is very acrid. The berries are poisonous, and even the smell of the flowers creates a burning sensation in the nostrils.

Dirca Leather Wood (D. palustris) is the only American variety. Flowers small, yellow, and funnel-shaped, appear before the leaves. The tough bark is acrid, and even blistering; is used for ropes, cordage, baskets, etc. The reticulated fibers may be separated and made into a kind of lace, as in the *Lagetta* or *Lace Bark* of Jamaica. ♃.

FIFTY-FIFTH FAMILY.—ARISTOLOCHIACEÆ.—(Class 10, Linn.)

The *Common Birthwort* (Aristolochus clematitis) is

an erect, smooth, climbing, herbaceous shrub; found everywhere in warm countries; grows in hedges, vineyards, etc.; leaves on very long foot-stalks, broad, ovate. Flowers small, in sessile clusters. Native of Europe; odor unpleasant; taste bitter. 2ℓ.

The *Dutchman's Pipe* (Aristolochia sipho). Stem woolly, twining, and shrubby; leaves ample, heart-shaped, and pointed; flowers solitary; the tube long and bent at nearly a right angle in the form of a siphon or tobacco-pipe, and of a dull brown color. An American plant, and highly ornamental, much valued in cultivation for arbors. 2ℓ.

The *Wild Ginger* (Asarum europæum) has a stem which is hardly visible, the true stem being the root, runs under ground. Leaves petiolate, reniform, in pairs; flower pale green; root has a pungent aromatic smell; creates nausea and vomiting; was formerly employed—being mixed in snuff. 2ℓ.

Virginia Snake Root (Aristolachia serpentaria), a well known and very valuable aromatic stimulant, belongs here. To the Aristolachia succeeds

The PASSIFLORACEÆ.—*Passionworts*, which, like the foregoing, are woody, climbing shrubs; very beautiful; calyx colored, deeply five-parted; the throat, with a complex filamentous crown. Fruit of various sizes; form a pulpy berry, containing small seeds, not unlike a gooseberry. Native of South America; cultivated elsewhere as an ornamental plant. The fruit seldom ripens except in the South, where it is called Markusa; is cooling and pleasant-tasted. The usual way of eating it is with wine and sugar.

FIFTY-SIXTH FAMILY.—EUPHORBIACEÆ.—SPURGEWORTS (German, Wolf's milk) are trees or shrubs often

abounding in an acrid milk. Many of them are poisonous, and many furnish esculent roots and fruit.

The *Box* (Buxus sempervirens) has oval, evergreen leaves. In the south grows into a tree twelve feet high. In the north of Europe and United States it is only a shrub. Leaves of latter small, numer-obovate; flowers yellowish, terminal. Many varieties. The wood of the Tree Box is very hard and used for inlaying fine cabinet work and wind instruments. ♄.

The *Common Euphorbia*, *Wolf's Milk* (Euphorbia officinarum), stalk woody below, upper part fleshy, many-angled, and prickly; leaves wanting, so that it has the appearance of a great cactus. The stalk contains a great quantity of milk sap, which flows partly spontaneously, but always very plentifully from an incision made through the bark, and when exposed to the sun becomes hard and resinous. This sap is very acrid; at first almost tasteless, it gradually becomes intolerably pungent; is poisonous and intensely cathartic; also used for producing vesication. According to the Koran, this tree grows in the infernal regions, and the unhappy beings condemned to perdition are obliged to eat it.* ♄.

The *Common Spurge*, *Male Tree* (Euphorbia esula) is a small plant, found growing by road-sides; leaves spiky, cuticular; flowers yellow, standing in rayed tufts. The stem is very succulent, and on being broken, pours forth a milky juice, said to be a specific for curing warts. 2f.

The *Gum Elastic Tree* or *Hevea Guianensis* (Siphonia elastica) of Persoon, is a tall tree, measuring sixty feet in height; leaves ovate, gray, petiolate, in-

* The violently drastic Croton Oil (Oil of Tiglium), the Indian species, belong to this genus.—*Tr.*

verted; flowers small and yellowish. Fruit as large as an apple, contains seeds which are eatable. Native of Peru and Guiana. The milky juice which flows from incisions being made in the bark of the tree, becomes hard and brown on exposure to the air, and is the well known Caoutchouc or India rubber, so useful at the present time in the manufacture of overshoes, water-proof coats, etc. ♄.

Palma Christi, Castor Oil Bean (Ricinus communis) is a shrub with an erect branching stem. Leaves shield-shaped on long petioles. Flowers bloom in tufts; bears a prickly nut (caps) containing seed. Native of East Indies, but cultivated in southern Europe and America; a rich oil is expressed from the seeds, which, at first almost tasteless, but afterwards found disagreeable and acrid, is the well known Castor Oil of the shops. One of its popular names is the Wonder Tree, because it is believed to be of the same species with that which, as mentioned in the Scriptures, grew in one night into a tree, under whose shade the Prophet Jonah sat when sent to preach to the people of Nineveh. In the south ♃, in Germany and the north. ☉.

The *Mandiœ* (Jatropha or Janipha manihot), leaves on under surface grayish-green, five to six-lobed, on long petioles; blooms in clustering racemes; stem crooked, about six feet in height, bears seed like the Palma Christi. Native of South America, where it is cultivated largely. The starchy accumulations in the rhizoma or underground portion of the stem, which is fleshy and of the thickness of an arm, forms the articles used for food. The starch thus obtained is the Cassava, which, when granulated, forms the Tapioca of commerce. Nevertheless, although the root furnishes this nutritious farina, it also

contains a milky sap, which, acrid and deleterious, is deadly poison to men and animals. Yet, it also is made useful, for, containing a mucilaginous sugar, which, by evaporation is made into syrup and perfectly innocuous, it is used as an accompaniment with meat and rice. Cassava is made by grating the root, pressing out the juice and drying it in the same manner as pursued with starch. By evaporation the poisonous portion is volatilized and the root is eatable; and the farinaceous portion is made into Cassava bread, which is like meal or wheaten cakes, and when fresh and slightly toasted, is well-tasted and nutritive. The native Indians use it largely, and prepare, by chewing the root and spitting it out into a vessel of water, where it undergoes fermentation, an intoxicating liquor, called Tapana, which they use largely at their festivals. The plant is a profitable article of trade; the root, after the juice is expressed and exposed to a due degree of heat, is eaten largely, and no danger feared from its use. ⊙.

The *Manchineal Tree* (Hippomane mancinella), leaves ovate, acuminate, dentate; height about forty feet; trunk strong, resembles a pear tree. Fruit, in color, form, and odor is so much like small apples, that any one is liable to be deceived by it; when ripe falls from the tree, and, instead of decaying on the ground, dries up. The whole tree contains a milky juice, which is a virulent poison—the fruit particularly so—it is said to destroy persons who sleep under its shade, and a drop of the juice falling on the hand or any portion of the skin, produces an instantaneous blister. Crabs are used as a remedy, and as the manchineal grows on the sea-coast in the West Indies, these crustacea are easily procured. The wood, beauti-

ful brown, marbled with white, is much used in ornamental cabinet work.

Fifty-seventh Family.—Ficus.—Trees or shrubs with milky juice; fruit fleshy and eatable; leaves large. Natives of tropical regions; none in North America.—(Class 23, L.)

The *Common Fig* (Ficus carica), leaves heart-shaped, three to five-lobed, lobes obtuse, scabrous (rough) above, pubescent (downy) beneath. Fruit is nothing more than the fleshy calyx or receptacle, pear-shaped, containing within its luscious pulp numerous small seeds of both sexes. Known from the earliest ages, and growing wild on the shores of the Mediterranean, is supposed to be a native of Caria, Asia; although now cultivated in all tropical climes, often growing into a tree twenty feet high. Figs in their fresh state somewhat resemble large pears; color dull red or yellow; those of the South are the best, because, in their unripe state being punctured by the gall-wasp, they mature earlier. The best figs come from Smyrna. This fruit, so delicious and well known, is used fresh as an article of food; dried, a favorite desert, and also as medicine. ♄.

The wide-spreading *Banyan* (Ficus religiosa) of India claims a place here.

The *Caoutchouc Fig* (Ficus elastica) is one of a numerous genera yielding caoutchouc, contains a milky juice, which, being dried, hardens into the article called Gum Elastic. A native of Nepal. Leaves ovate, oblong, petiolate, smooth, and glossy; is a very handsome tree, and is kept in conservatories as an ornament. ♄.

The *Black Mulberry* (Morus nigra). Leaves heart-shaped, ovate, or lobed, obtuse, unequally serrate; flowers fertile; spikes oval; fruit resembles that of the

blackberry, dark-red, and of an acrid aromatic flavor. Native of Persia, but long since naturalized in Europe and America. ♄.

The *White Mulberry* (Morus alba) is distinguished from the former by its leaves which are oblique, unequally serrate, either undivided or lobed; fruit whitish berry. Native of China; cultivated for sake of its leaves as the food of silk-worms. ♄.

The *Bread-fruit Tree* (Artocarpus incisa). Leaves oblong, much cleft, downy beneath; the flowers aggregated into fleshy heads; the fleshy receptacle, like the fig, forming a compound baccate fruit. The common bread-fruit is distinguished from the Otaheite; both, however, attain to the size of a child's head; the first contains a multitude of seeds or kernels, about as large as chestnuts, which, boiled and roasted are eatable, but by no means palatable, having a disagreeable earthy taste; the latter have a yellowish farinaceous pulp, which tastes much like good potatoes. The first is propagated by planting the seeds, the latter by scions. Both bear fruit the whole year, but that they are so prolific that three trees are sufficient to afford ample food for one man, as travelers have related, is one of the exaggerations which those who go abroad frequently indulge in. Comparatively, their product is small, and it would require thirty trees, rather than three, to furnish an annual supply for one person. The common bread-fruit tree is planted everywhere in tropical countries; the Otaheite but rarely, on account of its bearing less fruit. ♄. A relative race, the celebrated *Cow Tree* (Palo de Vaco, Don., Galactodendron utile), found in South America, yields a copious supply of rich milk, which is pleasant to the taste, and can be drank with safety. The tree which yields

the resin called Gutta Percha, the yellow dye-wood called *Fustic* (Maclura tinctoria, Don.), and the reputed deadly *Upas* (Antiaris toxicaria, Leschen), most likely deserve to be ranked with this family.

FIFTY-EIGHTH FAMILY.—URTICACEÆ.—(Class 22, L.)

Hemp (Canabis sativa) has a stiff, upright stalk, rough and crenate; leaves petiolate, palmately five to seven foliate. Leaflets lanceolate, serrate. Male and female flowers easily distinguished; the first is termed fimble hemp and the latter seed-bearing. Flowers small, green, solitary, and axillary in the barren plants, spiked in the fertile ones. Introduced from Persia and India, is cultivated in many countries. Seeds inodorous, but have a sweetish, oily, somewhat nauseating taste. The green plant, however, has a strong smell, which produces stupor, or has an intoxicating influence, wherefore it is considered very unwholesome to sleep in a hemp field or in any place where the odor is inhaled to any extent. It is a well known fact that children have been killed by it. The fibrous portion of the stalk, treated like that of flax, is spun into yarn for coarse cloths, or made into cordage. Hemp is treated as follows: after being pulled it is laid in water and left to a partial decay, so that the fibers may be separated from the resin which confines them; then transferred to clean water; next spread out in a grass field, and exposed to the influence of the sun and dew. After this it is heated or dried in a kiln, until the fibers begin to separate from the woody portion of the stem, which has become decayed and brittle. A succeeding operation is to break it, which is done with an instrument made of wood, and adapted to the purpose; the tough fibers are now relieved from the greater portion of the wood, and the hemp subjected to the further pro-

cess of *scutching*, which is performed by hanging it over an upright board called a *scutching-block*, and beat it with a bat. Last of all it is drawn through a large iron comb called a *heckel*, and afterwards spun into yarn. The male plants—pulled earlier than the female, which are left standing that the seed may ripen—yield the finest quality of hemp. Seeds furnish good food for birds, and are also used medicinally.*

The *Hop* (Humulus lupulus). Stem twisted, angular, and always twining with the sun; leaves very rough, three to six lobed, heart-shaped. Found wild in hedges, etc., both in Europe and America, and, as is well known, extensively cultivated for the sake of its fertile aments, used in the manufacture of beer. Flowers of both sexes found on the same vine. Flowers of the fertile plants in aments with large scales, and covered with yellow farina, called *hop-meal*. Odor peculiar, strongly balsamic, produces sleepiness; taste, bitter aromatic. Used largely in all liquors prepared from malt; also considered to possess medicinal qualities, and recommended in dyspepsia and diseases of the kidneys. ♃.

Common Nettle (Urtica urens). Leaves ovate, elliptical, five-ribbed, deeply and acutely serrate, armed with stinging hairs. Flowers in axillary, branching, hispid spikes; the stinging or burning sensation caused by contact with the leaves of this plant, and dreaded by all who approach it, is supposed to be produced by an acrid sap which exudes through the capillary hairs, rather than by the pricking of the hairs themselves. Spirits of hartshorn is the best remedy; where this is not at hand, fresh earth can be used. ☉.

* Not so largely cultivated in the United States as formerly.—*Tr.*

Stinging Nettle (Urtica dioica). Leaves cordate, acuminate, deeply serrate. Flowers pistillate or staminate; grows, like the former, everywhere, in rubbish-heaps, waste places, etc.; a regular nuisance in United States, although in some localities in Europe it is treated as hemp, and manufactured into a fine fabric called *Nettle cloth*. ♃.

The *Elm* (Ulmus campestris) of Europe is a handsome tree, fifty to eighty feet high; flowers bell-shaped, greenish, dark red, appear in March, before the leaves; grows everywhere in Middle Europe; wood hard and tough, is much used by coach-makers.*

FIFTY-NINTH FAMILY.—CUPULIFERÆ.—MASTWORTS. —Oaks which are the largest and handsomest trees found in the European forests.

The *Common Oak* (Quercus ruber). Leaves on long petioles, smooth, obtusely sinuate, lobes obtuse. Flowers, sterile or fertile; latter bloom in greenish catkins. The acorns grow in groups of three and four together, an inch long, in deep, warty cups. The oak attains to a height of one hundred and twenty feet (in the forests of Germany), and a diameter of six feet, standing firmly for more than a century. Wood very valuable for ship-building, or in plows or mill-work. The bark is em-

* The *White* or *Weeping Elm* (Ulmus americana) and *Tawny Elm*, *Slippery* or *Red Elm* (Ulmus fulva) are peculiar to America. The first, sixty to eighty feet high, branches long, spreading, often rather drooping, is a noble shade tree—used for that purpose in New England. Grows in low grounds, along streams; not very common. The latter, more frequent, found in rich low grounds, fence-rows, etc. The inner bark of this species is so charged with mucilage, that it has been added to the Materia Medica of our shops. Of smaller size, not so proper for a shade tree as the foregoing. Classed in *Flora Cestrica*, Darl., as Ulmaceæ.—*Tr.*

ployed in tanning, and the bitter, astringent principle it contains is used for medicine in many diseases. Acorns, roasted, are used by many of the peasantry of Europe as a substitute for coffee. Also useful as mast for swine. A relative species is found in Persia, Lesser Asia, etc., viz., the *Gall Oak* (Quercus infectoria), the leaf-stalks of which, being pierced by the gallwasp, the sap, exuding through the puncture, forms the ink or oak-galls, well known in commerce; the *Cork Oak* (Quercus suber), whose bark is well known as cork-wood, grows in Spain and Italy, and the *Holm* or *Stone Oak*, with its evergreen leaves and edible fruit, which tastes like filberts, are all members of the Cupuliferæ family. ½.

The next is

The *Walnut Tree* (Juglans regia). Leaves alternate, pinnate, nine-paired; leaflets ovate-oblong; fruit, a dry drupe, with a wooden or bony nutshell, containing a large, four-lobed, oily kernel. Originally a native of Persia; now grows everywhere in Europe and America within the temperate zone. The wood of this noble tree, *Black Walnut*, dense and fine-grained, rivals the celebrated mahogany in the manufacture of furniture. The seeds, or ripe fruit, are eatable, and generally esteemed; they yield a considerable quantity of oil. The unripe fruit of the *English* and *White Walnut* make an excellent pickle, and the large stem-root, beautifully veined, serves for inlaying or fine carving. ½.

The *Hazel* (Corylus avellana) is a large shrub or small tree; leaves roundish-ovate; stem six to ten feet high, branching in erect twigs from base. Flowers staminate, pistillate, separate; the latter arranged in catkins. Furnishes the pleasant fruit esteemed as hazel-nuts or fil-

berts. Wood is good for burning, or made into walking-canes.*

Witch Hazel (C. hamamelis), the young, forked twigs of which constitute the celebrated divining rod used to discover the localities of precious metals and subterranean fountains, the *Dwarfed Filbert* (C. rostrata), and *Wild Hazel Nut* (C. americana) are relative genera. The European filbert is more oblong, ripens earlier, clothed in a red envelope and kernel of richer taste, is perhaps the best of the species.

The *Beech* (Fagus sylvaticas). Leaves broadly ovate, elliptic, glossy, slightly toothed. A very handsome tree; branches thick and spreading, form a leafy crown at the top; trunk straight and round, often measures one hundred feet in height. Flowers both staminate and pistillate; the latter, the female, bloom in catkins. Fruit —beechnuts—furnish excellent mast for hogs; also yield excellent oil; wood hard and white, makes good fire-wood. The *American Chestnut* (Fagus castanea), nuts smaller than the Spanish chestnut, but sweeter than the European variety, and the *Dwarf Chestnut* (C. Pumila), *Chinquapin*, found in the Middle States, are relative genera. ♄.

Sixtieth Family.—Saliaciaceæ.—Willoworts.—A large number of genera belong to this tribe, which are trees or shrubs, mostly of slender form, sometimes with thick trunks. We can, however, notice but a few.

The *Bedford* or *Brittle Willow* (Salix fragilis). Leaves long, slightly toothed, acute at each end;

* Originally imported into Italy from Pontus, the fruit was known among the Romans as *Nux Pontica*, afterwards changed into *Nux Avellana*, from the Avella near Naples, where they had been most successfully propagated.—*Tr.*

branches with greenish-brown bark; twigs remarkably brittle. Grows into a tall tree beside water-courses; flowers pistillate or staminate, bloom in catkins. Bark of the twigs bitter and astringent, and, with the leaves, used in Europe instead of the Chinese herb as tea. ♄.

Weeping or *Drooping Willow* (Salix babylonica). Leaves small, linear, lanceolate, usually sharply serrate, dentate; much cultivated as an ornamental shade-tree. Branches long, slender, perpendicularly pendulous, as if drooping from grief, very naturally indicate the English name of weeping willow, and, regarded as an emblem of mourning, is generally planted beside graves. Tournefort terms it *Salix orientalis;* Linnæus, however, gave it the name which it now bears, in allusion to the 137th Psalm, "By the rivers of Babylon, there we sat down; we wept when we remembered Zion. We hanged our harps upon the willows, in the midst thereof." Flowers all pistillate. The *Common Osier* (Salix viminalis, L.) is highly prized for basket-work. *Swamp Willows*, etc., are varieties of the genera. All thrive best in damp places. ♄.

The *Black Poplar* (Populus nigra). Branches erect, leaves triangular, acuminate, serrate; is a tolerably large tree. Native of Europe, where it grows in damp woods; flowers all pistillate, blooming in catkins. Wood not much esteemed. ♄.

The *Lombardy Poplar* (Populus pyramidata). Leaves three-cornered, serrate; stem sixty feet high; branches erect, forming a pyramid; planted in streets of towns and elsewhere, as ornamental. There are several relative species, among which are the *Abele* or *Silver-leaf Poplar* (P. alba), with leaves dark green and smooth above, very white, downy beneath; the *Quaking Aspen*

of Europe (P. tremula), and the western *Cotton Tree* (P. angulata) (P. tremuloides).

The *White Poplar*—American aspen. Leaves dark green on petioles, two or three inches long, and laterally compressed, so that they can scarcely remain at rest in any position, and are thrown into excessive agitation by the slightest breeze. ♄.

Sixty-first Family.—Betulaceæ.—Birchworts. —The first of this race is

The *White Birch* (Betula alba). Leaves triangular, deltoid, very taper-pointed and serrate; distinguished by their beautiful green color. A beautiful tree, with chalky-white bark, easily separable into sheets or layers. If the trunk is bored into in the spring-time, a very sweet sap is obtained. Grows in America from Pennsylvania to Maine, but not so abundantly as in Northern Europe or Asia, where it forms great forests. Flowers unsightly; both sterile and fertile arranged in drooping catkins; the wood valuable for fuel. ♄.

The *Erle* or *Alder* (Alnus glutinosa). Leaves subplicate, ovate, glutinous; bark brownish-gray; stem or trunk about fifty feet high; grows in swampy grounds where no other tree will thrive. Flowers, male and female, in pendulous catkins. Bark, very hard, is good for firewood. The wood, often handsomely veined, is excellent for wagon-making, mill-posts, and woodwork of dams; as, being harder even than that of the locust, it does not decay in the water. Not good for burning, and makes very poor charcoal. Bark of branches used by tanners and dyers. ♄.

The *Plane Tree—Buttonwood—Sycamore* (Platanus occidentalis), a native of North America, but often planted, as an ornamental tree, in Europe. The largest,

but not loftiest tree of the American forest, the trunk often measures from forty to fifty feet in circumference, or more than thirteen feet in diameter. Leaves five-cornered, very large; flowers in globular aments or balls, which hang upon the tree on long pedicels for the greater part of the winter. The bark is detached yearly from the trunk in great scales.

Sixty-second Family.—Abietineæ.—Pinus.—This genus is distinguished by their leaves which are acerose (needle-shaped), in fascicles (little bunches or bundles) of two or five, and evergreen. The tree itself contains a great deal of turpentine; flowers both staminate and pistillate. Grows in all the northern countries throughout the world; delights in dry soils, therefore mostly found on barren hills, mountains, or sandy bottoms. Staminate aments scattered or clustered near the ends of of the branchlets. Fertile aments lateral or terminal somewhat clustered or solitary. Most of them are tall and slender trees, others low and scrubby.

The *Pine* or *Scotch Fir* (Pinus sylvestris) has pointed oval, overhanging cones, with obtuse scales; leaves stand in pairs, are rigid, prickly, and bluish-green. Is a beautiful tree, forming whole pine forests in the north and middle of Europe. Bark reddish-brown, peals off in large pieces from the trunk. The wood is used for building and burning, in the last respect of little importance; the wood of the root, being very resinous, is known and employed as torch-wood. On an incision being made into the trunk, a thick, yellowish, gummy substance flows from the opening, which is the *Common Turpentine;* this resin afterwards is distilled, and well known as *Spirits of Turpentine.* The residuum of this distillation is *Rosin.* Tar and pitch are both made by

burning pine wood in pits properly arranged. That which flows first from the melted turpentine is tar; the latter, darker and thicker, is pitch, and the portion left from both is subjected to a severer burning, and made into lamp-black, used in the preparation of printer's ink, etc. ♄.

The *Pine* (Pinus pinea). One of the handsomest of the Abictineæ, reaches to a height of fifty feet, spreading at the top so that its crown resembles an umbrella. Bears a large, thick cone containing seeds which are eatable, and taste like hazel-nuts. Native of Southern Europe, and particularly of Italy. ♄.

The *Siberian Stone Pine* or *Yew-leaved Fir* (Pinus cembra). Spikes or needles three-cornered, standing in in fascicles, four or five, cones erect; young twigs or branches rusty red and hairy. Seeds unwinged and nut-shaped, called *Pine-nuts,* are eatable. Found in the Eastern Alps and Carpathian Mountains; wood very beautifully grained and sweet smelling, is used by the Alpine peasants for carving into ornamental toys, etc. ♄.

Weymouth or *White Pine* (Pinus strobus). Leaves long, fine, triangular, spiky; strobiles (cones) cylindric-oblong, nodding; seeds long-winged. This beautiful and useful tree, with its smooth, resinous bark, and regularly transverse branches, is a native of North America, and most valuable for the excellence of the lumber it affords for building materials. Cultivated in Europe as an ornamental tree only. ♄.

The *White Larch* (Pinus larix). Leaves an inch in length, limber and obtuse, arranged in beautiful, pencil-like tufts, fall off in winter. Branches arching and bending, have a most graceful appearance. Grows mostly on the mountains of Europe, but now becoming quite

frequent as an ornament to grounds. Often transplanted abroad on account of the excellence of its wood for building purposes; very enduring, it is altogether suitable for mill or other water works. It also affords the Venice turpentine, and a substance called *Manna of Briançon.* One native species (L. americana, M.) found on our mountains. ½.

The *Cedar* (Pinus cedrus) is very large; grows to a great height; a remarkably handsome tree, with wide-spreading branches, and spiky leaves, an inch long. The cedar has been famed since the earliest times; wood of a reddish color, with a most pleasant odor. The beams in Solomon's temple are described in the Bible as being made of this wood. Native of Syria, it nevertheless bears transplanting into Northern Europe; for instance, the large cedar, celebrated for its immense size, now growing in the Botanical Garden at Paris, was a small plant brought by Tournefort in 1734 from the East. Of the cedars of Lebanon it is said that there are not more than a dozen remaining. The wood, only used at present for burning as incense, is very scarce and costly. The tree known in South America as cedar, the wood of which is used in making cigar boxes, lead pencils, etc., does not belong to this family, having rather leaves than spikes.

The *Red* or *Norway Pine* (Pinus abies), leaves dark evergreen, in pairs, channeled, four-cornered, stand collected towards the ends of the branches; cones ovoid conic (rhombic four-sided), pendulous; scales armed towards the end; seeds long-winged. Considered one of the best forest trees in Europe and America. Its slender trunk, in youth covered with a smooth reddish bark, which, when the tree is old, becomes rough and fissured,

reaches, in the space of eighty or one hundred years, a height of many feet. This pine affords a fine-grained resinous timber of much durability and strength; affords turpentine equally with the fir, and on account of its handsome pyramidal form is often cultivated as an ornament.

The *Noble Pine—Balsam Fir* (Pinus picea). Leaves sub-secund (on each side like the teeth of a comb) emarginate; flat, obtuse, with two white stripes on the under side. Cones erect, cylindrical; scales and bracts obovate, tipped with an abrupt slender point; scales and seeds falling from the axis at maturity. The bark of the trunk is whitish, scales off in thin flakes when the tree is old. Called in America, *Canada Balsam* or *Balm of Gilead Fir*, in Europe, *Silver Fir*. This beautiful tree, which in Europe reaches to a height of one hundred and twenty feet, abounds in Germany; found mostly in the mountain regions, where dark and extensive forests are composed of it, as, for instance, the Black Forest. The wood, tougher and more elastic than that of the common pine, is preferable for building purposes—not so good for fuel. The resin it exudes is known in Germany as Strasburg Turpentine, in United States, Canada Balsam.

The *Yew Tree* (Taxus baccata), Tourne. Leaves evergreen, small, flat; fruit red and berry-like, without stalks. This handsome tree grows wild in southern Europe, but is often transplanted in the north. Grows forty feet high in its native soil; wood, hard and reddish, is good for carved work; was formerly employed for making bows, hence its classical name from *taxon*, an arrow.*

* Arrows were formerly poisoned with the juice of the yew tree —*Tr.*

The leaves and sap of the bark are said to be narcotic and injurious.

The *American Yew—Ground Hemlock* (T. Canadensis) is a low and straggling bush, never forming an ascending trunk. ♄.

The *Juniper* (Juniperus communis), leaves in threes, sitting close, prickly, pointed, is an evergreen shrub, found in northern Europe and Asia, on hills and pasture lands; grows also in America in dry, sterile hills, from New Jersey to Maine, eastward, northward, and along the great lakes. Berries hang on the bush two years; are at first green, next purplish, and, last of all, black. Contain a volatile oil and a portion of sugar. Odor balsamic and agreeable; taste sweetish bitter, is aromatic and exciting, and used, in some countries, for seasoning dishes; employed in Holland as a principal ingredient in the making of gin. ♄.

The *Cypress* (Cupressus sempervirens), Tourne., is a large evergreen tree; trunk slender, in form resembling the Italian poplar; leaves consist of short, minute scales of a dull green color. On account of its somber appearance it is, in the East, planted in burial places. Native of the whole Levant, Italy, and Spain; found also in the United States in swamps, which it densely and exclusively occupies. Wood agreeably odorous, hard, and reddish-yellow, is used in the manufacture of shingles, pails, posts, etc. ♄.

Arbor Vitæ (Thuja occidentalis) is a tree of about fifty feet high; branches spreading, diminishing in size upwards; leaves, evergreen, consist of branchlets more flat and broad than those of the cedar; cones oval and terminal. Abound in the British provinces and Northern States. Transplanted in Europe as an ornamental tree.

CLASS II.

ENDOGENOUS OR MONOCOTYLEDONOUS PLANTS.

Stem not distinguishable into bark, pith, or wood. Growth by irregular internal accretions, consisting of bundles of vessels and woody fibers, not arranged in concentric rings, the last-formed lying close to the axis; germ, or embryo provided with a single seed-lobe (cotyledon), or if the second is present, it is alternate with it and so much smaller, that neither germ nor spore are apparent.

SUB-CLASS I.—ENDOGENS WITH SEED.—THE ORCHIDACEÆ OR ORCHIS FAMILY.

The plants belonging to this class possess both germ and seed vessel, plainly developed.

SIXTY-THIRD FAMILY.—ORCHIS.—This genus consists chiefly of small plants, mostly perennials with tuberous or thickened roots.—(Class 20, L.)

Ragwort (Orchis morio, Ambrosia, Tourne). The inflorescence of this plant resembles grains of small shot; leaves lanceolate and spotted; flowers purplish, spicate, or racemous. The small grains, containing much gluten and starch, are used in the east as Salep or Saloop. They are prepared by first having hot water poured over them and then dried quickly in the sun. Used as medicine, but principally as a seasoning to chocolate. There are many varieties of orchis found in the United States. ♃.

The *Lady's Slipper* (Cypripedum calceolus). Leaves oblong, lanceolate; root fibrous; flowers yellow, shaped

like a lady's shoe. Grows in meadows and woods from Newfoundland to Carolina; rare in Europe; found only on mountains. 2f.

Vanilla Plant (Vanilla aromatica), plate 28, fig. 5, has a climbing stalk, which twines or fastens itself on trees, like ivy; leaves fleshy, ovate, or lanceolate; stem succulent, round, and about as thick as a finger; roots itself by its joints in the bark; flowers, white, stand in terminal racemes; fruit a kind of pod, about a span in length, in thickness the size of a small finger, brown and fleshy. The pulp, also brown, is full of small seeds; the odor delightfully fragrant; taste sweet and aromatic. Stimulating and of delicious flavor, it forms a favorite seasoning for chocolate and various other confections. Native of South America; cultivated in Mexico. The monkey race is excessively fond of this plant, and visiting the vanilla plantations in troops, commit vast depredations on the ripe fruit, therefore it is usual to keep a strict guard against these destructives.

Sixty-Fourth Family. — Zingiberaceæ. — The plants of this genus resemble reeds. Flowers mostly beautifully colored; fruit or root contain a quantity of stimulant or aromatic substance.

The *Cucumber Root—East India Cucumber* (Curcuma longa). Fruit or knob oblong, palmate, spreading; internally yellow; leaves reed-like, lanceolate; flowers yellowish-white, arranged in ears or spikes; cultivated largely in China and East Indies. Root faintly pungent and aromatic, is used as ginger; chiefly valuable for the beautiful gold color extracted from it (Turmeric), which, however, of exceeding brilliancy at first, fades very soon. 2f.

Ginger (Zingiber officinale). Leaves small, lanceo-

late; flower[illegible]*wn Imperial* (Fritilaria imperialis), flowers spikes. Na[illegible]erianth campanulate; stem thick, high, lower to West Ind[illegible]d with the long, narrow leaves, bearing at the peculiarly pl[illegible]e of several large red and yellow flowers, and biting. F[illegible]own formed by the pairs of small, narrow sugar. Its op[illegible]base of each pedicel. This well known varieties of this[illegible]he gardens has an unpleasant odor, and and *Cardamum*, the seed[illegible] narcotic poison.

and known by the name of Paradise[illegible] Root or bulb is composed a common me[illegible]

Arrow Root (Maranta arundinaceæ) [illegible]-like; branches forked; leaves lanceolate; flowers paniculate, standing in sixes. Cultivated largely in South America. Root about three inches long, white, and of the thickness of a man's thumb, affords the well known arrow-root starch, so often employed as pleasant and nutritive diet for invalids and weak children. It is, however, frequently adulterated with starch, which deception may easily be detected in the boiling, the starch making it paste-like, but when pure it is more fluid and transparent. Proportion of arrow-root flour to water or milk, 1–80.

SIXTY-FIFTH FAMILY.—LILIACEÆ.—LILYWORTS.—(Class 3, L.)

The *Sword Lily* (Iris florentina). Leaves sword, or rather, sickle-shaped (falcate); flowers white, without foot-stalks, bearded yellow; flowers sometimes bluish; the root, hard, knobbed, and limbed, has a pleasant odor, resembling that of violets, known as orris-root, and often given to children in teething to bite on. Cultivated in gardens in middle Europe, but found growing wild in Italy. A relative species and neither so rare or valuable, which has violet flowers, is often met with farther north. 2f.

like a lady's shoe. Grows in meadows and ... Root tuber- Newfoundland to Carolina; rare in Europe; ... fine fibres; on mountains. 2f. ... ms springing

Vanilla Plant (Vanilla aromatica), plat... uite sessile, is has a climbing stalk, which twines or fast... of a beautiful trees, like ivy; leaves fleshy, ovate, or lan... he plant, both succulent, round, and about as thick as ... n the stigmas, itself by its joints in the bark ... cinnon. Native of the terminal racemes; fruit in South Germany, France, and northern ... thy, also in America. The odor is penetrating and aromatic, and, if largely inhaled, narcotic; taste spicy, bitter. Used for coloring, in cookery, and medicinally. As it commands a high price, it is often adulterated. 2f.

The *Narcissus—Poet's Narcissus* (Narcissus poeticus). Scape about a foot high, straight, one flowering, two edged; flowers mostly white, but having the crown singularly adorned with circles of crimson, yellow, and white. Very fragrant, wherefore it is frequently planted in gardens. Native of southern Europe; found in meadows. ♄.

Snowdrop (Galanthus nivalis) is snow-white, the outside slightly tinged with green. These beautiful flowers come forth in early spring, peering above the snow. Root a small brown bulb; leaves which do not appear until after the flower is faded, are long and of a bright green color. ♄.

The *Amaryllis* or *Jacobea Lily* (Amaryllis formosissima) is also a bulbous root; flower fine dark red, somewhat nodding, is very splendid; perianth, or flower-envelope, six-cleft, comes before the leaves. A native of Mexico, often grown with us in large pots; blooming in spring, is a favorite parlor flower. ☉.

The *Crown Imperial* (Fritilaria imperialis), flowers nodding; perianth campanulate; stem thick, high, lower part invested with the long, narrow leaves, bearing at the top a raceme of several large red and yellow flowers, beneath a crown formed by the pairs of small, narrow leaves at the base of each pedicel. This well known ornament of the gardens has an unpleasant odor, and contains a strong narcotic poison.

Garlic (Allium sativum). Root or bulb is composed of many smaller ones, surrounded by a common membrane; stem leaved midway; leaves flat; flowers small, white, and in a dense umbel. Originally from the East, it is cultivated everywhere. Odor very penetrating and unpleasant; taste sweetish and spicy; used medicinally as a vermifuge and by many as seasoning in a variety of dishes. ⊙. Many varieties; *Meadow*, *Field*, or *Crow Garlics*, etc.

The *Common Onion* (Allium cepa), stem and radical leaves tubular; flowers white, bloom in dense umbels or terminal heads; root, a bulb depressed or turnip-shaped, consists of a number of succulent layers; the juice they contain has a peculiarly strong, irritating odor; taste is sweetish, but, in most varieties, very unpleasantly pungent. Nevertheless it is considered a good vegetable.

Cives (A. schænoprasum) and the *Shallot* (A. ascalonicum) are nearly related; both are natives of tropical lands.

The *Sea Onion—Squill* (Scilla maritima). Bulb ovoid and very large; leaves, long and linear, come after the flowers; shaft or stalk high, terminates in a pyramidal tuft of white flowers. Grows on the sandy flats of the Mediterranean. Has a strong and pungent odor;

taste acrid, sweetish, and bitter. Used medicinally in pulmonary and other complaints. ☉.

The *Hyacinth* (Hyacinthus orientalis), flower (perianth) funnel-form, half six-cleft; color blue or pink, standing in dense thyrsoid racemes. Leaves rather long and partly folded together. This splendid plant was brought originally from the East; at the present time much cultivated everywhere, but particularly in Holland. Propagated by bulbs. ☉.

The *Agave* or *Aloe* (Aloe vulgaris), leaves lanceolate, spiny, dendate, and fleshy, often curling at the point; the root cylindrical and ligneous (woody); flowers greenish-yellow, bloom in clusters; the leaves afford a bitter juice, which is obtained, partly by boiling them, and partly by making incisions into their fleshy structures. This sap exposed to the sun hardens into a resinous gum, extremely bitter, which is used in medicine. Native of the torrid region of Africa, but transplanted into West Indies. The best sort of aloes is brought from Barbadoes. ♄.

The *Tulip* (Tulipa gesneriana). Scape (flower-stem) one-flowered; flower large, erect, mostly red, but sometimes variegated; leaves ovate, lanceolate. Originally from Lesser Asia, now cultivated everywhere in Europe and America as an ornamental garden plant; in some places in Germany found growing wild. There are many varieties. 2ℓ.

The *White Lily* (Lilium candidum) has a thick stem or stalk clothed with numerous short, alternate scattered leaves; radical leaves lanceolate, narrowed at base; flowers snow-white and very fragrant, have long been regarded as the emblems of innocence and purity. Native of

Palestine, but highly ornamental, now planted in gardens everywhere. 2ℓ. Next is

The *Pine Apple* (Bromelia ananas), root fibrous and thick; leaves, rigid, dry, and spiny on the edges, are three feet long and three inches broad; the fine fruit which is formed by a consolidation of the imperfect flowers, bracts, and receptacle into a fleshy succulent mass, rises on a stem about a foot in length from the middle of the leaves. The stem, before the fruit is formed, has a terminal tuft of leaves and purple flowers, and again another crown of red or yellow leaves. Fruit, like the artichoke, is overgrown with leaves, often one foot in length and six inches in breadth, is yellow, pulpy, and of delicious flavor. Seeds small and brown, and pear-shaped. Grows almost everywhere in South America, thrives best in sandy soils, and is as a refreshing cordial to the wayfarer in those arid wastes. The wild pine apple, however, is by no means so luscious as that nurtured by cultivation, but has a harsh taste. Propagated by planting the tufted crown or lateral sprouts; the first produces better plants, but are longer in attaining to maturity. It is a common practice to cut the pine apple very thin, and pouring wine over the slices, let it remain all night; the wine pressed out in the morning, will be found to have imbibed all the delicious aroma of the fruit. A relative race is

The *Singalassi* (Bromelia sagenaria), which bears fruit of an inferior kind; nevertheless, is not less useful, as the fibrous leaves, treated as hemp, is converted into a similar, but more enduring fabric. When matured by the same process as has been described, it is manufactured into ropes, whips, nets, etc.

The *Tree Aloe* or *Century Plant* (Agave americana),

acaulescent, herbaceous; scape covered at base with leaf-like scales, above with broad, fleshy leaves, spinous on the borders, five to six feet long, and eight inches wide. Scape arises from the center of the mass of leaves to a height of from fifteen to twenty feet, bearing a pyramidal panicle; four thousand, it is said, of greenish-yellow flowers, which, as soon as fully expanded, die. It is a popular notion that it blooms but once in one hundred years, but it is known to flower oftener. Much depends on the culture it receives. In Mexico the peduncles or knobs, from which the scape producing the fruit is to spring, are cut off, the richly-flowing sap collected, and made into the well-flavored wine called Pulque. The fibrous portion of the leaves spun into thread, and manufactured into coarse fabrics, linen, sail-cloth, etc., and said to be very enduring. Paper can also be made from them; the old Mexicans, in the days of their glory used them for that purpose. The root contains a reddish-colored bitter juice, easily extracted by spirits of wine, which is used medicinally. Found growing wild on the shores of the Mediterranean since the sixteenth century.

The *Banana* (Musa sapientum) is a tree-like shrub, twelve to thirteen feet high; stem consists of a sheath composed of different layers like that of an onion; crown leaves eight to ten feet long and two feet broad. Distinguished by a simple perianth and five to six perfect stamens. When the plant is five to six months old a tuft of buds comes forth on the crown; at the base are from thirty to sixty androgynous flowers, six-staminate; at the terminal portion shoots forth a globular cone composed of violet-colored flowers, pistillate, which secrete a quantity of sweet juices. The staminate flowers hang in cluster, forming each a single fruit, which gradually

attains the size of a common cucumber. After ten or eleven months, this fruit is what is called tree-ripe, contains a mealy pulp, in the middle of which is a slender column surrounded with very small seeds; the rind is at this time green. When fully matured, which is not until ten or twenty days afterwards, the rind turns yellow, and the pulp becomes sweet and glutinous. There are now two kinds of fruit to be found on the same tuft; the larger fruit, of which there are fewer, viz., the staminate or male fruit, and the pistillate, or that produced by the female flower; the former are the best. In the tree-ripe state bananas are good and wholesome articles of food, are used boiled or roasted, and taste like a mixture of corn meal and potatoes; when fully ripe, they are eaten as fruit. In South America the banana forms the chief article of food for the negroes. The tree after producing such a crop of fruit, often forty to sixty pounds, is altogether exhausted, therefore the usual practice is to cut the top off and turn the remaining portion downwards, so that new scions may spring up from the root to maintain the stock. The acerb sap being pressed from the leaves and seeds, the fibrous portion which remains serves to be manufactured into cordage and a kind of rough paper. This genus, known by the various names of Pisang, Plaintain, and Paradise Fig, is native of the East Indies, now, however, found throughout the torrid zone; was known to the ancients by the name of Pala. Many believe the banana (paradise fig) to have been the tree by whose fruit Eve was tempted; others, with more probability, suppose that the great clusters, brought by the Jewish spies from the Valley of Eschol, which were so heavy that it required two men to carry

one, were not grapes, but the clustered fruit of the banana. There are many varieties known at present.

The *Bakuba* (M. paradisica), bearing a small fruit of about a finger's length and proportionate thickness, left to ripen fully, is very pleasant-tasted, resembling a bergamot pear, but is a much finer fruit. The superior variety of Bakubas contain no seed. ⊙.

Sixty-sixth Family.—Palmæ.—Palm.—The most majestic race of plants. Palms are scarcely ever found beyond the limits of the tropics, where they not only delight the eye with the beauty of their structure, but refresh the weary wanderer with their fruit. The young shoots are used as articles of every day diet, and the pulpy pith—of some eatable—is appropriated to various uses. Seldom found growing in numbers together so as to form a grove; when they do their majestic beauty is lost, presenting nothing to the eye besides a disproportionately small crown of leaves, and a columnar mass of gray trunks. They mostly grow singly in the neighborhood of other trees, and are to the tropical forests what the pine is to the northern. The reader must not suppose that the palm tree casts a spreading shadow, under which the traveler may repose, for its entire foliage consists of about a dozen large, feathery, fan-like leaves, forming a crown at the top, therefore the poet's dreaming "under the shade of the lofty palm" is sheer nonsense. Neither ought it to be supposed that the palm yields so abundantly, that its fruit, cabbage, and vinous sap can supply a whole colony with food and drink. The so-called cabbage, which is the terminal bud of the trunk, does indeed furnish a delicious article of food, but the procuring of it costs the life of one beautiful tree, and if eaten for any length of time brings on dysentery.

The fruit is either oleaginous or pulpy, like our summer fruits, therefore not solid enough to furnish every day food. The tapping of the trees for sake of the sap, also mostly takes away their life; procuring sago from the trunk of the Palm sagus, E. India, found growing in the Mauritius, and said to contain a large quantity of that article, is followed by the same consequences. The accounts of the extreme fruitfulness of the palm, given by travelers, are greatly exaggerated, as any one who travels in their native region, unprovided with a supply of solid food, will find out, the stomach refusing to be satisfied solely with its produce. Nevertheless, the palm family, in its numerous varieties, is eminently useful, affording food, raiment, wine, oil, wax, flour, sugar, thread, weapons, habitations, and utensils. Although there are many genera of this race, we shall only mention two or three.

The *Date Tree* (Phœnix dactylifera), the leaves of which are the palms of Scripture. A native of northern Africa, endures the climate of the opposite shores of the Mediterranean, and the *Palmetto* (Chamærops palmetto), the only arborescent species of the United States. One or two low palms with a creeping caudex (dwarf palmettoes) are found from Florida to North Carolina.*

The *Sago Palm* (Sagus rumphii) is a large tree, although it does not measure more than thirty feet; leaves pinnate with large segments; leaf-stalks spiny. Of slow growth, the sago palm remains a naked shrub for a long

* The Palmaceæ are perhaps not surpassed by any other order in point of usefulness. The leaves are used for thatching, making hats, mats, baskets, fences, for torches, and for writing upon; the stalk and midrib for oars; their ashes yield an abundance of potash; the juice of the flowers and stems, replete with sugar, is fermented into a kind of wine or distilled into Arrack; from its spathes, as from some other

time; at length a sheath from which sprouts a very large panicle, appears in the middle of the plant, the whole resembling an immense candelabra. Flowers hang in catkins. The fruit is uneatable, and contains hard kernels like small shot. The useful part of this tree is the central pith, which is taken from the stem before the terminal bud begins to shoot. This pithy portion resembles fine meal, and known as the East Indian Sago, is used largely as nutritive food. Native of India. ♄.

The *Cabbage Tree* (Euterpe oleraceæ), seventy feet in height. This palm is a handsome tree, growing perpendicularly straight; stem two-thirds gray below, upper third green; the feathery-leaved crown, light and graceful, is pleasing to the eye. Under this crown are the sheaths, from which the flower-tufts or bulbs develope; fruit, a berry altogether uneatable. As long as these flower-bulbs remain soft they can be taken out and eaten as are the terminal buds of the true palm; so, also, the young unopened leaves. If the tree is cut down and the trunk left lying on the ground, the palm beetle deposits its eggs within them, and the numerous larvæ soon develope, adding, it is said, much to their excellence; found everywhere within the tropics. The *Royal Palm* is a relative species. ♄.

The *Maritz Palm* (Mauritia flexusa) has a straight, smooth stem and fan-like leaves; height sixty feet; flow-

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palms, when wounded, flows a grateful beverage, known in India as Toddy; the rind is used for culinary vessels, the outer portion into very strong cordage (Coir rope); the kernels, expressed, make oil. Canes and ratans are the slender, often prostrate, stems of species of Calamus. The *Phytephelas* of South America yields the larger sort of nuts, the hard and white albumen of which is the vegetable ivory, now so largely used by the turners.—Gray.—*Tr.*

ers bloom in catkins; bears berries or fruit about the size of a hen's egg, contain when perfectly ripe a brownish-yellow pulp, which adheres closely to the seed; used, partly eaten as fruit, and mixed with water as a refreshing drink. The natives prepare a kind of hemp from the leaves, which, although very strong and tough if kept dry, decays soon when wet. Its true home is South America, where it is found in swampy places only. ♄.

The *Date Palm* (Phœnix dactylifera), plate 27, fig. 1. Trunk knobbed and rough; leaves pinnate; leaflets small and lanceolate; fruit red or brownish, about the size of a plum, egg-shaped, somewhat recurved. The trees are of different sexes, being both male and female. Native of southern Asia and northern Africa, the date palm has thence been transplanted into Arabia and Persia. Great care is expended on the culture of this tree, because the livelihood of the cultivator depends as much upon their annual harvest as does the European farmer upon the measure of his crop of grain. Only a few of the male trees are kept on the plantation; the pollen-bearing branches are, however, cut off and preserved for a whole year without injury to their fructifying properties. The date season or harvest is a regular festival time; all flock to assist in gathering the ripe fruit; the song, the dance and merry sports lend an enlivening influence, and driving away care, all are merry. Some of the fruit is eaten green (not dried); in this case it is carefully separated from the riper, which, dried and sent abroad, is known and welcome everywhere. In our country dates are considered a luxury, and recommended to invalids as both nutritive and refreshing. In Arabia they are used as common food both for man and beasts. ♄.

The *Komu Palm* (Œnocarpus bacaba) is a tall and slender tree, measuring about fifty feet in height; leaves small and pinnatified; fruit, pulpy drupes, amounting to several hundreds, and about the same size as shot, and resembling sloeberries, are borne on broom-like panicles, from two to four feet in length. The stone is very hard, but the pulp surrounding it is brown and tastes like chocolate. This fruit soaked in warm water until it is softened and grated makes a very refreshing beverage, and tastes much like chocolate; the panicels serve for making brooms, and the wood for canes and umbrella stocks. Found abundantly in South America. ♄.

The *Avara* (Elais guinensis) is slender and very thorny, measures forty feet in height; leaves two to three feet long, pinnatified, and falcate. Flowers paniculate, producing a drupaceous fruit, four to six hundred, plum-shaped and yellow. The hard black kernel of the nut contains the oily principle from which the article, called in Africa Palm Oil, is made. The avara has been transplanted into South America; the fruit serves there only as food for swine.

The *Maripa Palm*, with its sweet pulp and handsome brown seeds bears much likeness to the avara; rings and other ornaments of the same kind are made from the seeds of the maripa, which are very handsome, but break easily. ♄.

The *Cocoa Palm* (Cocos nucifera) has no thorns; leaves sword-shaped, is one of the most useful trees upon the earth, very large, and grows in the sandy and most unfruitful regions of the torrid zone. Even when too young to bear fruit, the tender leaves afford palatable food, and are used as cabbage. Flowers yellowish, stand in paniculate clusters, followed by fruit, the well known

cocoa-nut, about the size of an infant's head, the outside rind of which consists of a fibrous covering, and a few coarse leaves resembling the bark of undressed hemp. Under this rough envelope the nut is found, large and obtusely triangular, brown and hard. A considerable quantity of milk, sweet, and tasting like almonds, may be obtained by boring into the shell, the inside of which is lined with a hard but oily flesh, rich and nut-like; the shell must be broken or sawed asunder in order to get at the pulp. Even the expanding sheaths are made subservient to useful purposes, for when cut into or wounded the sap flows freely, is very sweet, and after undergoing a certain process of fermentation, converted into palm wine, which is considered a very superior liquor. The shell of the nut is used by turners for ornamental work. The small branches of the cocoa nut palm, emblematic of peace and friendship, are planted on festival days in front of houses. The wood is very fibrous, and therefore not fit for building purposes. Found everywhere within the tropical regions, although its true home is in the East Indies. ♄. To this genus succeeds that of

The *Yam* (Dioscorea alata), which is a handsome, herbaceous plant, cultivated everywhere within the tropics; stems twining from large tuberous roots; leaves alternate, ovate, arrow-shaped; flowers small and yellowish, form thick clusters a span long, the sterile in drooping panicles, the fertile in drooping, simple racemes, and the whole growth of the plant is so luxuriant, as of itself to form an arbor. The most important part, however, are the tuberous roots, which, in one year are larger than the largest-sized apple; left in the earth for a longer time, they still continue to grow; contain a great deal of starch, and very mealy, taste like the best

potatoes, and furnish the well known Mandioc meal. It is necessary that the roots be well covered with earth, as the exposed portion is very bitter. Yams are much valued as a nutritive every day diet. 2f.

Calamus—Sweet Flag (Acorus calamus). Leaves linear, two-edged, sword-like; roots creeping, long, branching out vertically. Grows in swampy places, margins of rivulets, etc.; found everywhere in Europe, abundant in Pennsylvania; about five feet high, and from the structure of its leaves has much the appearance of a large sword-lily. The root, reddish outside, white within, is pungent, bitter and aromatic to the taste, but of an agreeable balsamic odor; preserved fresh with sugar, it makes a pleasant medicine, used as a stomachic and tonic. Originally a native of Asia. 2f.

The *Pepper Bush* (Piper nigrum), plate 27, fig. 2, is shrub-like and climbing; leaves ovoid, egg-shaped, pointed, leathery, and naked; flowers arranged in spicate racemes. Fruit, composed of grains, about the size of peas, which hang together in clusters of from twenty to thirty, of a red color; ripens in four months. Pepper is taken from the bush before it is fully ripe, and left to dry in the sun; eight or ten days is sufficient for this purpose; the red color is changed into black, the grains hardened, and now become fitted for an article of commerce, it is exported and known as Black Pepper. White pepper, which is considered superior to black, and commands a higher price, is the fruit of the same plant and the same berry, but divested of the red pulp; used everywhere, and valued by all for its conservative properties, no further description of this valuable spice is necessary, since every one is familiar with its peculiar aromatic odor and pungent taste.

SIXTY-SEVENTH FAMILY. — GRAMINEÆ. — GRASSES. —Stems usually hollow and jointed or with nodes, from which the leaves, partly surrounded with a membranous ligula or stipule (membranous appendage) at the base of the leaf or summit of the sheath in the grasses. Inflorescence very abundant, arranged in spikes, panicles, or racemes. The seed or grain clothed first with a fine thin skin, is also enveloped in another covering, which, of an oblong shape and dry, is known as chaff, and many have the chaff furnished with awns, a bristle-like process, called beards or barbs. The plants belonging to this order, Gramineæ, the largest of the vegetable kingdom, and most universally diffused, are also doubtless the most important; the nutritious herbage, whether used green as pasture or dry as hay, and seeds constitute the chief support of herbivorous animals, and the cereals, seeds or grains filled with floury albumen, and cultivated carefully everywhere, furnish food for man. Many of these farinaceous seeds also contain a considerable portion of sugar. The most important meadow and pasture grasses are

I.—CYPERACEÆ.—SEDGES.—HALF GRASSES.

The *Sandsegge—Sand Reed—White Grass* (Vignea arenaria). Root creeping; leaves small, flat, striped; stalk very tall; palæ (chaff, or immediate floral covering), oblong; triangular ears; thick spikelets; blooms in May; grows in sandy bottoms, and furnishes indifferently good fodder for cattle.

Reed Cut Grass—Sedge (Vignea acuta), root creeping; leaves small, flat, sharply cutting; chaff, or husk, oblong, strongly bristled, slender; spikelets (ears) brown.

Grows in pasture lands on the borders of stagnant waters; blooms in May or June; as food for cattle rather indifferent.

Low or *Creeping Reed Grass—Sedge Grass* (Carex supina). Root creeping; glumes, (outer chaff, or stunted leaf sheaths), small and sharply acute; stalk smooth, tall, rigid; ears or spikes small. Grows on hills and in dry pasture lands. Blooms in May and makes indifferent fodder.

Early Reed—Bent Grass (Carex præcox), creeping root; leaflets small, acute, boat-shaped; chaff-glumes smooth, poor; ears wedge-shaped. Found in sunny places, appearing verdant as soon as the snow is gone. Flowers in March, April, and May. Sheep eat it with great readiness.

II.—Agrostideæ.—True Grasses.

The *Common Red Top—Bent Grass* (Agrostis vulgaris) has a running root; leaves linear, flat, rough; stalk or stem one foot high, erect; panicle spreading, with the branches finally divaricate. A common grass, spread over hills, vales, and meadows, forming a soft, dense turf. Blooms in June and August, and makes valuable fodder for sheep.

The *Dog's Bent Grass* (Agrostis canina), root creeping; upper leaves linear, flat; lower rather crowded at base of the stem, rough; spikes upright or bending, smooth; grain triangular, ovoid, dark brown. Blooms in July and August, and in the latter part of summer makes a fine turf, alike over dry and damp places, yards, lanes, etc. Cattle, sheep, and hogs are fond of feeding on it.

German Fenning Grass (Panicum germanicum, L.) has small leaves; stem rather short and erect; flowers in panicles; blooms in July and August; makes good fodder for cattle, and on that account is cultivated in many places. Crop or Crab Grass.

The *Canary Seed Grass* (Phalaris canariensis), leaves flat; stalk high, nearly smooth, rather bent; panicle oval, spiked; blooms in July and August; sometimes, but sparingly, cultivated for the sake of the seed, which is used as food for parlor birds. Cattle eat it very readily.

Timothy—Cat's Tail or *Herd's Grass* (Phleum prætense). Root very fibrous; leaves flat; stem high, smooth; spike cylindrical, very dense and harsh; flowers in upright ear-like panicles of unequal lengths. Blooms in June, July, and August; grows in meadows, and although a rough grass, is very valuable as hay.

Meadow Fox-tail Grass (Alopecuris prætensis), root tufted and fibrous; leaves long, smooth; stem tall and smooth; inflorescence spike-form, cylindric, and of a tawny-yellow; flower-sheaths woolly or bristly; blooms in May or June; abundant in meadows and pasture-fields. Several species of *Floating Fox-tail* (Alopecurii), found in moist meadows, *Water Fox-tail*, rather rare, growing in water or wet grounds, all make excellent food for cattle.

Sweet-scented Vernal Grass (Anthoxantum odoratum). Leaves flat; stalk tall, erect; spikelets yellow; flowers in spiked panicles; blooms from May to July; found in high-lying pasture-lands, sunny meadows, etc.; very sweet-scented in drying; taste also very sweet; makes excellent fodder.

The *Hair Grass* (Aira flexuosa) has leaves resembling

bristles; stem tall, smooth; flowers not numerous, in loose panicles; an erect, elegant grass, growing in tufts. Grows on hills or in shady woods, and with all others of the Avenæ tribe, makes rather poor provender for cattle.

Tall Oat Grass—Golden (Avena flavescens), root somewhat creeping; leaves flat, and clothed with soft white hairs; stem one and a half to two feet high; flowers yellow; spikelets in panicles; blooms in June and July in meadows and lots or by road-sides, and with all other genera of the arrhenatherum, is eaten readily by all species of cattle.

French Ray Grass or *Honey Grass* (Holcus avenaceus) resembles oats; root tuberous and knotty; leaves flat and sharply pointed; stem hollow and bare; inflorescence-spikelets from two to five; flowers in a large, loose, somewhat nodding panicle; bloom in June, July, and August. Grows in fields, and meadows, etc.; succeeds best in tolerably rich soils, endures for many years, and can be cut for hay two or three times in one season; makes excellent fodder.

Common Ray Grass—Brome Grass (Bromus giganteus), leaves oblong, broad, naked; stem three to four feet high; panicles small and loose; flowers in June, July, and August. Grows in moist fields and damp woods, and, like all other grasses of the bromus tribe, makes alike very poor pasture and hay.

Sheep's Fescue or *Manna Grass* (Festuca ovina). Leaves very narrow and sharp-pointed; stem one to two feet high, almost four square; panicle few-flowered, simple, and contracted; blooms in May and June. A valuable grass, grows in dry soils, is common, and affords with all others of the fescue tribe, excellent pasturage for sheep.

Orchard or *Cock's Foot Grass* (Dactylis glomerata), leaves small, flat, and very sharp on the margins; stem erect, from nine to eighteen inches long, oblique, geniculate, often procumbent and radiating at base; panicles spicate, pyramidal; blooms in June, July, and August; grows well in dry meadows, and makes very good fodder.

The *Common Rough Meadow Grass* (Poa trivialis). Root tufted; leaves small, naked; stem round, two to three feet high; panicles loose, expanding; grows in moist meadows, and, like all the other meadow grasses, makes good hay.

Coutch or *Quitch Grass* (Triticum repens). Roots creeping; leaves sharp above; sheaths smooth; stalk from one to three feet high; spike solitary, ear-like; blooms from June until September; grows in all fields as a common weed. Makes good fodder; the root contains a portion of mucilaginous sugar, which is used medicinally. Native of Europe, but introduced into the United States.

Rye Grass—Darnel (Lolium perenne), root creeping; leaves small, sharply pointed; stalk one to two feet high; spike compressed, slightly bearded; blooms from June until September; grows wild in pasture fields, but is also carefully cultivated on account of its excellence as fodder.

The most important of all the grasses belongs to the triticum race, namely:

Common Wheat (Triticum vulgare), which has a fibrous root; leaves rather rough on the upper surface, and long; stem smooth, two to three feet tall, crowned with an almost four-cornered terminal spike, on which the grains arranged somewhat like tiles, form an ear.

These seeds are, in most of the varieties, naked, or without any floral envelope, but strongly bearded; in a few of the species, however, the beards are altogether wanting. Native of Asia, wheat has been cultivated since time immemorial in Europe, and as a breadstuff is entitled to a preference above all the other cereals. The finest bread, starch, etc., is made from it, and in some places is used in making malt for beer. Cultivated as a spring and winter crop. ☉.

Spelt (Triticum spelta) has a fibrous root, with a loose, compressed, terminal spike, on which the grains are parallel, and arranged like tiles on a roof. Beards or barbs very small and fall off easily. Stem about four feet high, but not naked, like the above mentioned. Used in Germany in the same manner as common wheat.

Emmer (Triticum amyleum), a species of wheat unknown in the United States; used in the North of Europe. Spikelets double-flowering; flowers alternately barren; chaff, in which the oblong seed remains acotid on a crooked shaft; makes good flour. ☉.

Single Wheat or *Peter's Corn* (Triticum monococcum). Spike compressed; spikelets triple-flowering; one bud fruitful, two abortive; chaff tri-dentate, external side-bearded; seed apparently triangular, remains in the husk. Grows in poor ground, and makes good meal. Native of Europe.

Rye (Secale cereale). One of the most useful of the grain race, rye is easily distinguished by its long, four-sided pendulous ear or spike, which is compressed; grain naked, arranged as tiles, imbricate, and strongly bearded. Rye produces a darker meal than the two foregoing cereals; nevertheless the bread made from it is very nutritive, and when newly baked, is sweeter than that of

wheat; it can not, however, be used for any kind of fine pastry. The seed is subject, particularly in very wet seasons, to become diseased and enlarged, producing Ergot or Spurred Rye. This diseased grain is injurious to health when made into bread, but has been found to possess important medical qualities in certain cases—requires a careful administration. Some late observers have considered it a fungous or mushroom growth. ☉.

Barley (Hordeum vulgare) has a very long spike; florets arranged in six rows, two of which, when the fruit or grain is ripe, are somewhat compressed, giving the ear a four-sided appearance; beards very strong; seed or grain covered with husks. Barley contains less flour than the other cereals, therefore it is cultivated more for the use of breweries, in making malt, than for bread-stuff. Barley-bread is unknown in the United States, nevertheless much barley is consumed in the form of beer. It contains a large portion of mucilage, which makes it very nutritive and wholesome; therefore often prepared in various ways for the use of invalids. Malt is made by wetting the barley and suffering it to germinate; thus a considerable quantity of sugar being developed, the whole undergoes a vinous fermentation, and beer is produced. Decoctions of malt are considered useful in pulmonary complaints.

Oats (Avena sativa). This cereal is distinguished by its loose and smaller panicles—not spikes—somewhat nodding, and without beards. Fruit, or grain, is enveloped in a husk, and contains less nutritive matter even than barley, therefore rarely used for making bread; although in Scotland many live on it, and oat-meal porridge, or *groats*, is often, in this country, recommended to invalids. It is cultivated in the United States, and elsewhere,

mainly as provender for horses, and in this quality is superior to any other grain. Besides the meal contained in its chaffy fruit, it possesses an aromatic property, which an accomplished cook can turn into all the uses of vanilla. Nevertheless, it makes bad bread. ☉.

The *Sugar Cane* (Saccharum officinarum), plate 28, fig. 1, has a stalk containing a solid pith, which is filled with a saccharine juice. Leaves linear-lanceolate, long, broad, acuminate. Flowers white, bloom in panicles, loosely branching; florets invested at base with tufts of long silky hairs. The true home of the sugar cane is Mesopotamia; man has therefore been acquainted with the use of sugar since the earliest times. In the middle ages, this plant was introduced by the Arabians into Crete, Malta, and Spain, and, after the discovery of America, transplanted by the Spaniards into the West Indies. The following slight description will give our readers an idea of the process by which sugar is made. The sugar cane is rarely permitted to flower, but after twelve or eighteen months' growth—at which time the stem is supposed to contain more sap than at any other—the stalks are cut off with a sickle, and put into a kind of press or mill. This press, however, is very different from that used in the making of wine, already described, and consists of three iron rollers, placed vertically or horizontally, between which the canes are passed and repassed, and which, pressing out the sap, leaves them completely dry. The machinery is propelled by steam or water power. The sap or juice is at first brown, and contains, besides the crystallized portion of saccharine matter known as sugar, a quantity of sweet but watery syrup, containing also a portion of essential oil and mucilaginous gum. This syrup is separated from the granulated sugar,

known to us as brown sugar, by various methods, which serve to elaborate the finest portions into loaf sugar, and separate the thickened syrup, also well known as molasses. Sugar has become an indispensable article in domestic economy; not only in the preparation of food, beverages, or cordials used in every day life, but is also employed medicinally. Rum is a distillation of the fermented juice of the sugar cane. Sugar candy is produced by a more elaborate process of refining; and in all the various forms of confectionary, preserves, etc., sugar is the principal ingredient. The cultivation of the sugar cane succeeds best in moist lands within the tropics, and is, on this account, considered an unhealthy business for Europeans; it does not, however, seem to be attended with the same deleterious effect to the natives or negroes. This noble grass is propagated by sections or cuttings from the root end, planted in hills or trenches, in spring or autumn, something in the manner of hops. The cuttings take root from the joints underground, and from those above send up shoots which grow so quickly, that in from ten to fourteen months they are six to ten feet long, and fit to send to the mill. Requires to be kept clear of weeds, and, although of such luxuriant growth, exhausts the earth so little that a good plantation will last from ten to sixteen years. 2ℓ.

Rice (Oryza sativa) also has its flowers arranged in a compressed panicle; spikelets are uniflorous, on pedicels, mostly without beards. It is, according to some, originally from the East Indies, others say Africa, but is now cultivated in all warm climates. Asia, Africa, and America furnish most. As rice contains a great deal of starch, it is never used for making bread, but prepared in various other ways for table use, forms an important

article in domestic economy. It must be cultivated in low grounds, which can be irrigated or overflowed with water, and is of the greatest importance to the inhabitants of the tropical regions generally, as its seeds enter more largely into their nourishment than those of any other plant. Likewise very profitable to the cultivator, as, in suitable soils, it yields three crops annually. There is a relative variety—the *Upland* or *Mountain Rice*. Grows in high and dry places, but is less cultivated. The aquatic variety is one of the staple crops of South Carolina. Arrack, an intoxicating beverage used largely in the East Indies, is a liquor prepared by fermentation and distillation, from rice, syrup of the sugar cane, and sap of the palm. ☉.

Millet (Panicum miliaceum) is distinguished by its loosely constructed panicle; spikelets rough and spiny, but without beards; grain small and glossy. Originally from the East Indies; called by some Bengal-grass; cultivated largely in Europe, partly as an article of food for man, but mostly employed for feeding swine. ☉.

Maize or *Indian Corn* (Zea mais). Stalk four to eight feet high; leaves two feet long and three inches broad. Believed to be a native of the warmer regions of middle America, but, transplanted into Europe, is frequently cultivated in South Germany, Hungary, Italy, etc. The ears or spikes stand in the axils of the leaves, are nearly a foot long, and measure five to six inches in circumference. Spikelets arranged in numerous series or rows on the cob. When corn is ripe, the grains are bright yellow; there are, however, other varieties, where they are white, bluish, and red. This cereal contains a great quantity of meal, is one of the most important of the *Gramineæ*, and serves largely

in the nourishment of man, animals, and poultry. The upper part of the stem, the husks, and leaves, cut in a green state, carefully collected, are valuable fodder for milch cows, and are much used in the Middle States as such. There are many varieties, all differing in size and in the amount of crop they yield. ☉.

Reed Grass (Arundo phragmates). Panicle large and loosely expanded, branching horizontally; spikelets lance-linear; three to five-flowered; stem six to eight feet high; grows on the edges of swamps. Leaves long, very sharp, so that the hand, coming in contact with them is easily wounded. Grows in the borders of swamps, etc. In the south the leaves are used as tiles for covering roofs, or as boards for ceiling rooms. The stems serve for making mouth-pieces of wind instruments. 2f.

The *Common Bamboo* (Bambusa arundinaceæ). Panicle branching, loose, expanding horizontally; leaves large, blue-green; is the tallest of all the grasses. Native of East and West Indies, in the neighborhood of pools. Stalks twenty to forty feet high, nodose (jointed), and, like the common reed, is hollow. It is dangerous to venture into a thicket of bamboo, as such places are a favorite resort of snakes and other venomous reptiles. The seed is used in the East Indies for feeding horses. The bamboo reed used for walking canes is of a different genus from the genuine bamboo, which is applied to a great variety of purposes. In India it is used for making boxes, baskets, tables, chairs, mats, boats, paper, fences, etc. The thick stems are used for beams in building. Wood very tough when sawed across, but splits or works easily lengthwise. 2f.

Second Sub-Class.—Cryptogamous Plants. (Class 24, L.)

Cryptogamous plants are constituted chiefly of cells; are unprovided, destitute of proper flowers (stamens and pistils) and seemingly without a germ, are propagated by spores instead of seeds. Acrogenous Plants.

Sixty-eighth Family.—Horse-Tails.—Equisataceæ.—The first of this family is

The *Field Horse Tail* (Equisetum arvense). Stems striped and grooved, branching; sterile stem nine to fifteen inches high, with a verticil of slender, articulated branches from base of sheath; fertile stems, appearing first, are simple. Grows everywhere in Europe, in fields, ditches, or by brook-sides; called Shave Grass.

The *Scouring Rush* (Equisetum hyemale), containing much silex, is used for scouring and polishing tin ware; is distinguished from E. arvense by its sharply angulate stem and short sheaths, with small, blackish, deciduous teeth at summit. Much used by cabinet-makers in polishing furniture.

Sixty-ninth Family. — Lycopodiaceæ. — Club-Moss Family.

Club Moss (Lycopodium clavatum), stems creeping; branches short and ascending; leaves long, linear, with an extended hair-like point; arranged in fives; form a tuft at the summit of the branches. Found in all the mountain forests of the Vor-Alps in Europe and Asia, also in woodlands and thickets in North America. The fruit of this plant appears in the form of a yellow mealy substance, which is called Witch or Vegetable Sulphur; of little use except for theaters or amusing children by

setting it on fire, and making mimic lightning, which can be very successfully accomplished. The tree-like *Lycopodium — Ground Pine*, much used for trimming churches at Christmas, is nearly related. ♃.

SEVENTIETH FAMILY.—FILICES.—FERNS.

Shield Fern or *Male Wood Fern* (Polipodium filix mas). This plant, common alike in the woods of Germany and our own country, has large, handsome leaves, or fronds, doubly pinnate, with round fruit-dots borne on the back or sometimes on the extremity of the veins, consist of a fine powder, which is the true fruit of the plant. The root, black and woody, is used medicinally, as it contains an essential oil and a quantity of resinous substance, which is considered a specific for destroying the tape-worm.

The *Maiden Hair* (Adiantum capillus veneris), leaves or fronds on long foot-stalks, smooth, doubly pinnate, light green; pinnules, or leaflets, recurved, semi-oval, eared, and alternate; fruit-dots oblong, occupying the edge or margin of the pinnæ; foot-stalk and peduncular axis glossy and brownish-black. Grows in the south of Europe, by rocks and damp walls; is used medicinally. Syrup of Maiden Hair, formerly much in vogue, is prepared from this plant. ♃.

A great variety of ferns are found in the South, some of them growing to an almost incredible size.*

* The tree ferns of the tropics, the stems of which are often erect, frequently attain a height of seventy or eighty feet. They are said to be objects of incomparable beauty, their straight, unbranched trunks often rising like those of palms, as high as forty or fifty feet without a leaf.—GRAY.—*Tr.*

SECOND DIVISION.

CELLULAR PLANTS.—ACROGENS.

These plants (Acyotogamous acrogens) are composed entirely of cellular tissue, and without vessels or ducts, producing spore-cases or capsules, opening by a terminal lid, and contain simple spores only, in this differing from the foregoing.

First Sub-Class.—Cellular Plants with Leaves

Possess leaf-like extensions and imperfectly developed organs of fructification; have no primary root; the axis growing from the apex only has no provision for increase in diameter as they increase in age. Acrogens—Acrogenous Plants (Greek derivation) means that they grow from the apex alone.

Seventy-first Family.—Hepaticæ.—Liverworts—Are small moss-like plants, the stem and leaves forming or confluent into an expanded leaf-like mass.

The *Marchanzie* or *Brook Liverwort* (Marchantia polymorpha) has large, cellular lobes, resembling oak-leaves; common, and growing beside brooks, springs, or by damp walls. Leaves are at first orbicular; first year only one inch long; calyptra (hood) opening at apex. Withers on the spot where it grew, rooting or ramifying from the free end. 2f.

Seventy-second Family.—Musci.—Hair Cap Moss.

Yellow Maiden Hair (Polytrichum commune). This beautiful moss is about one foot high, has small branches

and slender, lanceolate leaves; capsule yellow and purplish red. Grows in moist grounds, mostly in damp woods. Used for making brushes, and, when found abundantly, for filling beds. 2f.

Second Sub-Class.—Unleaved Cellular Plants. Thallophytes.

These vegetables, called Thallophytes, from their peculiar conformation, never exhibit any distinction of root, stem or foliage, axis or leaves, and are without any visible indication of the fructifying principle. The first of this class is the

Seventy-third Family.—Lichens, which are, of all vegetable structures, the most widely spread. Consisting of flat expansions, rather crustaceous than foliaceous, they do not, like other plants, require earth on which to root or draw subsistence, but merely a place whereon to fasten by their lower surface, while by the upper they draw their nourishment directly from the air. They grow on every brick, stone, or naked rock, upon trunks of trees in endless variety, and are ever enduring. The most conspicuous of the race is

The *Iceland Moss* (Cetraria islandica), grayish-green or brown, stands upright, spotted red on the lower part. Leaves irregularly lobed and many-cleft; fruit (or what is supposed to be such) flat and of a chestnut brown. Grows on the ground in dry, mountainous, open places, also in pine forests; found in very cold countries, as Iceland, Lapland, etc. Contains a great deal of mucilage, starch, and a bitter principle—probably tonic; forms the chief article of nourishment of rein-deer, and is recom-

mended as a strengthening and nutritious diet for consumptives.

The *Archil Moss* (Roccella tinctoria). Branches but little, erect, cylindrical, gray-green. Grows abundantly on the cliffs of southern Europe, Azores, and Canary Islands; contains a red coloring matter, which, on the dry plant being powdered, discharges itself in a strong alkali. Blue is also obtained, but through an entirely different process.

SEVENTY-FOURTH FAMILY.—ALGÆ.—SEA-WEEDS.—KELP.—Consist of aquatic plants, found mostly in the sea, but some grow in humid terrestrial situations. The highest forms are the proper sea-weeds, *Wrack*, *Tang*, *Dulse*, *Tangle*, etc., which, spreading their rank luxuriance through the water, represent extended meadows.

The *Bladder Tang* (Fucus vesiculosis), leaves often a fathom in length, banded or ribbed an inch in breadth; on the stems are found globular cells, which are filled with air, and when put into the fire, explode with a noise like a pistol shot. Found abundantly in the Mediterranean Sea, also in the eastern and northern oceans as far as Greenland; is often driven by heavy floods on land, where it is gathered, dried, and used as bedding straw for cattle; boiled, it makes good food for hogs; it is also burned for the sake of its ashes, from which alkaline salts (alkali), containing a large portion of iodine, are made; therefore the sea tang is very useful, although seemingly a weed.

There are many relative species of Algæ, several of which, when dried, resembling coarse hair, are used to stuff mattresses, chairs, etc.* 2ℓ.

* The *Lessonia* and *Macrosystis*, the two giants of the Ocean Flora, are natives of the Antarctic seas. Many as are the beautiful varieties

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SEVENTY-FIFTH FAMILY.—FUNGI.—MUSHROOMS—Are pithy, cellular plants of various forms, which spring forth from damp soils; the rapidity of their growth (accomplished in one night, for it is not uncommon to find a crop of mushrooms in the morning where not one was to be seen on the previous evening) is proverbial. Many of the race have a hood or umbrella seated on a slender stem, called by many Witch Caps. Some are fashioned in round knobs, others consist of fine branches. The smallest of all the race are composed of very fine, gray filaments, and are termed *Schimmel* or the *White Horse.*

Buffist—Puff Ball (Lycoperdon bovista) consists only of a leathery sack; grows as large as an infant's head, whitish yellow, ragged, in broad scales; when ripe is full of a rust-colored powder; when unripe, the pith is white and soft; at that time is fit to be eaten. Said to be very palatable when roasted; also used officinally.

The *Common Truffle* (Tuber cibarium). Truffles are nearly globular, firm; tubers about the size of a walnut, and blackish. The pulp or pith consists of a series of fine cells. This species of mushroom is hidden under the earth, they are ripe in autumn, when they have a pleasant

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which are dredged upon from the rocks, or washed ashore by the tides, these two collossal specimens are all we can at present mention. The Lessonia is an arborescent sea-weed, with a trunk of concentric layers altogether timberlike, but, nevertheless, incombustible. The Macrosystis (mooredkelp) instead of a trunk as thick as a common cherry tree, is moored to the rock by a tough but slender cable, which, rising to the surface, breaks into leaves and streams along a luxuriant tangle for several hundred feet, is at once the buoy and breakwater of the dangerous channels where it finds its home. The Moored Kelp not only warns the mariner of a sunken rock, but is the pasture-field of countless mollusks or crustaceans.—*Tr.*

garlic-like odor, and make a much-prized article of food. They are not easily found, therefore dogs are trained to seek them, which they do by smelling on the earth. Hogs are very fond of them and on that account are suffered to root at pleasure in the neighborhood where they are supposed to be, as they are sure to find them. 2f.

The *Common Moril* or *Edible Mushroom* (Morchella esculenta), plate 29, fig. 1, is two inches in length, dark brown; cap oval, pointed; grows in the woods here and there, and is eaten. ⊙.

Coral-shaped Moril (Clavaria coralloides), plate 29, fig. 2, fashioned as a white or yellow tuft, which, branching very beautifully resembles coral. Comes up plentifully after rain, and is eatable. ⊙.

The following belong to the genuine Agariceæ:

Stone Moril (Boletus edulis), Plate 29, fig. 3; stem six inches long, fleshy, red, which is surmounted by the cap or umbrella, five inches in breadth, smooth and brown, and consisting on the lower surface of a number of roundish tubes, which are at first white, afterwards yellowish, and, at last, turn green. Tastes like hazelnuts, and frequently used as a table dish. ⊙.

The *Chantrelle* (Cantharellus cibareus), plate 29, fig. 4, 5, is about two inches high, yellow; cap smooth, fleshy, diffuse, and sloping. Grows in the pine woods of Europe, and is generally used as food. ⊙.

The *Oronge* (Agaricus campestris), plate 29, fig. 6, 7. Stem white, surmounted by an umbrella-shaped cap of fleshy consistence and silk-like interior; the inferior surface is lined with a brown, sporiferous membrane or kind of lappets. Found in fields throughout the summer, and is the most esteemed and best-flavored of the Agaric race; known in Europe as the Champignon. ⊙.

The *Imperial* or *Golden Agaric* (Amanita cæsarea), plate 20, fig. 8, 9, one of the handsomest and best proportioned of the mushroom family, has a hollow, yellow stalk about six inches high, with a smooth, yellow ring, and issuing from a white valva or wrapper. Cap from four to six inches in breadth, is glossy, gold-colored, and umbrella-shaped; sometimes covered with white warts; has one broad, sulphur-colored leaf, bordered with one stripe. Found abundantly in the chestnut woods in the south of France and Italy, mostly in autumn; considered very excellent. Fig. 9 is a representation of the young plant, which, from its likeness to an egg, receives the name of the *Egg Mushroom*.

Nearly all the Agarics, properly so-called, are in Europe esteemed as good and wholesome food, and growing, especially in wet seasons, so abundantly in woods and meadows, it seems almost to be regretted that they are so little used. This proceeds from want of a proper knowledge of their true nature, and therefore, as there are many of them poisonous and closely resemble the edible species, persons are afraid of mistaking one for the other. The difference, however, between the true and the false is easy of acquisition. Those which change color quickly after being gathered, or of a soft, watery structure, have a peppery, bitter, astringent taste and disagreeable odor, ought invariably to be rejected. The edible mushrooms have a fresh, earth-like smell, and in taste resemble hazel-nuts, and even these must be carefully selected, as some among them, although not actually poisonous, contain an acrimonious juice, and when eaten, are attended with unpleasant consequences. In order to be secure from such effects, all mushrooms previously selected and cleansed ought to be tied up in a thick cloth

and put into an earthen jar, placed on a moderately warm hearth. After remaining thus for half an hour, the cloth will be found to have absorbed much of the juice, which is largely exuded by this simple process; the cloth still containing the mushrooms must now be well wrung, and the mushrooms, freed entirely from their juices, are now ready for the different modes of preparation in which they are used, either for an every day dish or as a condiment for meats. They are often collected and kept for winter use. The mode of preparing them is the same as has just been described. After the juice or watery portion has all been pressed out, they are strung on cords and dried either in the sun or a bake-oven. Any one who does not shun taking a little trouble, might, in his common walk through the woods, learn to recognize the nature of these despised plants, and having done so, would find himself repaid, not only by the interesting study, but also by the acquisition of a wholesome and palatable dish.

INDIGENOUS POISONOUS PLANTS.

Poisonous plants are divided into two kinds, acrid and narcotic, founded upon the difference of their operations, although both are attended with the same deadly effect. Some, however, possess the principles belonging to both, therefore, in their effect, they are said to be sharp or acrid narcotics. The most prominent specimens of the simply acrid poisonous plants are the *Arum*, *Savin*, and *Spurge Laurel;* simply narcotic. *Henbane*, *Deadly*

Nightshade, Aconite; of the acrid narcotic, *Monk's Hood, Hemlock, Tobacco, Digitalis,* and *Stramonium Apple.*

The symptoms attending the operations of the simply sharp or acrid poisons are commonly pain, inflammation, and redness of the throat, difficulty of swallowing, great nausea and thirst, in short there is a general disturbance of the whole system. When the operation is at its full height, the face is pale and the features sunken, and expressive of great anxiety; the eyes are surrounded with blue circles, the breath is short, the voice fails, cold sweats and faintings ensue, and, with slight convulsions, death ends the scene.

The operation of the narcotic poisons is different; heaviness of the head, dimness of sight, deafness, giddiness, stupor, delirium, often very violent; the face is sometimes inflamed, at others very pale; the eyes have a fixed and vacant look, the pupils at intervals dilated or sunken, and the pulses of the neck and brow are very full and quick; cramp of the muscles, spasms, tetanus; in short, a general paralysis ensues, which only ends when death comes, which, in such cases, is mostly with convulsions or apoplexy. As nausea is seldom present, therefore emetics are not only useless, but hard to bring into operation. The plan of treatment in either case must be modified according to the nature of the poison and symptoms of the case, as well as a proper understanding of the constitution to be operated upon. Many remedies are resorted to for counteracting the effect of the poison, but as it is best to resort to medical aid at once, we shall only suggest a few domestic simples, which can be used in cases where a physician can not be had at once. In the first stage, warm water, plentifully

mixed with melted butter or salad oil, has a good effect, and new milk is especially useful. Decoctions of mucilaginous plants, slippery elm bark, ground ivy, barley water, mingled with something astringent as oak bark, tormentilla root, come next; afterwards applications of ice to the head, leeches to the pit of the stomach, and sometimes general bleeding is sufficient for the removal of the poison, but it is always safer in cases of poisoning from vegetables, to have recourse to medical treatment than to trust to simples, however judiciously administered.

Aaron's Root (Arum maculatum), known by the common name of *Indian Turnip*, has an oblong, turnip-shaped root; leaves in pairs, arrow-shaped, and on long petioles or foot-stalks; stem shorter than the leaf-stalks; flowers separate, seated here and there on the dark brown stem, like those of the well known calla, and have the appearance of small fruit, wherefore children are fond of gathering them to play with. Grows in damp, shady places in woods and thickets; occasionally found in meadows. Blooms in April or May. The root called Cormus, is very acrid, and, if not exactly poisonous, is very severe in its operation and productive of serious injury; however, that quality is dissipated in a great measure by boiling or drying. When eaten in a fresh state, the best remedy against its painful effect is, as it is also in all cases of acrid poisons, milk in which raw eggs have been mixed. 2f.

The *Mandrake—May Apple* (Atropa mandragora). Root long, thick, forked, cylindrical, and yellowish-brown; stem one or two-leaved at summit; leaves large, round, seven or nine-lobed, lanceolate, peltate, and slightly haired below; flower situated in the fork of the

petioles, large, yellowish-white, somewhat downy; fruit, a large, yellow, fleshy berry, ovoid, and filled with numerous kidney-shaped, dark brown seeds; grows in woods; fruit ripens in July, slightly acid and maukish, eaten by pigs and boys. The mandrake is found abundantly in southern Europe, and in the days of early superstition, the forked root, supposed to possess magical power, was used in sorcery or divination. Belongs to the class of acrid narcotic poisons—the root and leaves only, for the fruit is innocuous; its effect and operation much resemble that of Belladonna.

Black Henbane (Hyoscyamus niger), plate 30, fig. 5. Stem erect, branching; a clammy, pubescent plant, fetid and narcotic; leaves oblong, angled, lobate, and toothed. Flowers (corolla) pale yellow, strongly veined with dark purple, increasingly dark towards the bottom. Very poisonous, grows in rubbish heaps, in hedges, and by road-sides; blooms in May and August. Every part of this plant is pervaded with an acrid narcotic principle, which is equally strong in leaf, flower, stem, etc. If eaten, its operation is very severe, producing headache, stupor, nausea, deafness, insensibility, and, at last, convulsions. Simple emetics are given, often successfully, doses of vinegar and lemon juice are common remedies used against its poisonous influence, and acidulated drinks, it is said, seldom fail to counteract it ♂.

Herb Christopher (Actaea spicata), called *Cohosh* or *Baneberry* in United States. Root annulate and many-headed. But diametrically, the wood presents a star-like circle with obtuse rays. Stem naked, smooth, about two feet in height; leaves one foot long, large, three-lobed, compound, glossy green; leaflets long, sharply cleft, downy on under surface; flowers white, hang five

to ten in terminal tufts. Fruit oblong and many-seeded. Grows in rich damp woods and bushy hills, both in Europe and America; is an acrid narcotic.

Wolf's Bane (Paris Quadrifolia), plate 31, fig. 6. Grows in damp places, shady woods, and mountain regions. Stem erect; leaves oblong, acuminate, notched at the apex. Flowers blue, helmet-shaped, spring from the axils of the leaves; fruit, a berry, resembles a small cherry, and tastes like wine. Very poisonous, creates cramp in the stomach, to which succeeds stupor and delirium; destroys life by producing gastric inflammation Milk and mucilaginous articles, as slippery elm, barley-water, sweet oil, etc., ought to be administered promptly until medical aid can be procured. 2f.

Monkshood—Aconite—(Aconitum napellus), plate 30, fig. 3. Leaves glossy, deeply three-cleft; flowers purred, blue, bloom in terminal spikes, and surmounted by the vaulted upper leaflet; bears much resemblance to a monk's cowl. Grows mostly on wooded hills or deep valleys; blooms in June and August; also cultivated on account of its beauty as an ornament in gardens. Every part of the Aconite is poisonous. Even the leaves, if rubbed between the fingers, have a disgusting odor, and an acrid, nauseating taste. Sleeping in the neighborhood of these plants is considered dangerous, especially if a number of them are together. Taken inwardly, their poison, in the first stage, creates vomiting, giddiness, delirium; coldness of the extremities and raging fever next ensue, and lastly death comes and the scene closes with convulsions. Bees cluster around the flowers, and suck honey from their cells without injury to themselves; nevertheless, the honey, if gathered in any quantity from these plants, is poisonous, and examples are not wanting of persons who

have died from eating it. The remedies mentioned above, namely, acids and mucilaginous drinks, are also proper antidotes to the poison of Aconite. 2f.

Foxglove (Digitalis purpurea), plate 31, fig. 5. Leaves oblong, wrinkled, crenate, recurved; the under side downy; flowers numerous, arranged around a long, simple spike; crimson, often white, with beautiful eye-like spots within the throat. Native of Europe, where it grows on high hills, and a well known, showy border flower of easy culture, but much more beautiful in its wild state than when cultivated in gardens. The fresh leaves, if bruised in the fingers, have a most disagreeable odor, and a mawkish, acrid, bitter taste. The whole plant is a violent and dangerous poison; when taken in considerable quantities, producing delirium, convulsions, and death. Its peculiar action on the heart is well known, and although possessing such dangerous properties, in the hands of the judicious physician it becomes a valuable medicine, acting as a sedative, etc. Acids, such as lemon juice and vinegar, mingled with mucilages, as barley water, etc., may be used advantageously until medical aid can be obtained. 2f.

The *Toad-stool* (Agaricus muscarius), plate 30, fig. 4. Cap, or umbrella, bright red, covered with white worts, which are the fragments of the ruptured envelopes of the *sporules*. Its leaf or leaves are white, clustered near the top of the stem, which is four inches high and one in diameter. Grows everywhere in the woods, and is one of the handsomest of the Agarics. Sometimes it is of a light citron color, and therefore may easily be mistaken for the much esteemed Golden Agaric; the stem and leaves, however, form a distinctive mark, those of the toad-stool being white, those of the imperial yellow.

Toad-stools have no particular odor or taste; nevertheless they are very dangerous, and their poisonous effect is immediately apparent. In an hour or two after being eaten, the throat swells, breathing becomes difficult, cold sweats, faintings, convulsions, spasms, sometimes dilirium; in short, there is a general disturbance of the whole system, and in twelve to forty-eight hours, death ends the suffering. A *post-mortem* examination shows inflammation of the stomach and an extravasation of blood on the brain. In poisonings from this species of Agaries, an emetic ought to be administered as promptly as possible; lukewarm water, in which melted butter, or sweet oil, is mixed is also proper. If attended with much pain, mucilaginous drinks—flaxseed tea, etc.,—and warm milk should be given freely, and cataplasms applied to the stomach. There are other symptoms, requiring other remedies, which come immediately under the care of a physician, by whom they can only be safely administered. The treatment in all cases of poisoning from vegetables is nearly the same. Some persons use this toad-stool, boiled in milk, to kill flies; it is, however, a dangerous practice. Nevertheless, the Kamschatdales prepare an exciting liquor from it, with which they intoxicate themselves to a certain degree. ⊙.

Puff-ball (Phallus impudicus), plate 31, fig. 2. A mushroom, about a span long, and as thick as a thumb; overgrown with a green, slimy substance. Grows in shady forests, mostly hidden in thickets: its presence, however, can be detected, even from a distance, by its disgusting odor. The ball explodes with a noise resembling a pistol shot. Many of the *Muscæ* tribe seek it, and deposit their eggs upon its surface. It is altogether

so disgusting, that, although highly poisonous, its bad effects are rarely found necessary to be combated. ☉.

The *Wild* or *Poison Lettuce—Trumpet—Milkweed* —(Lactua virosa), much resembles the L. sativa or Garden Lettuce; lower leaves clasping the stem horizontally, upper arrow-shaped; flowers yellow, in spreading panicles. Grows rankly beside stone walls, and in hedges; stalk hollow, stout, three to five feet high; flowers open only in the morning. Whole plant has a most unpleasant odor; if eaten, tastes acrid and bitter. Its poison produces stupor; symptoms resembling those produced by hemlock. The same remedies are proper. Used medicinally as a sedative. ☉.

Poison Oak, or *Sumach* (Rhus radicans). Leaves oval, oblong, abruptly acuminate; blooms in racemous axillary panicles; flowers, androgynous, divided; color yellowish-green; stem sometimes six feet high, according to species, at others climbing thirty to forty feet, by means of radicating tendrils, which fasten themselves on trees, etc.* Every part of this plant contains an acrid resin very poisonous to the taste or touch, even tainting the air to some distance around with its pernicious effluvium, so that in damp weather many persons become poisoned by it merely from passing or by remaining a short time in its neighborhood. In such cases the skin becomes inflamed and covered with an eruption, mostly attended with painful swellings. The best remedies are simple sudorifics, such as decoctions of elderberry flowers and acids, or local applications of dry heat. Cooling washes,

* The climbing variety, Poison Ivy, is the proper Rhus radicans (the *Poison Sumach*, called in the United States Rhus venerata) and the *Poison Oak* (Rhus toxicodendron) are the erect variety. All are more or less poisonous.—*Wood.—Tr.*

such as sour cream, etc., are sometimes employed for the inflamed parts.

Hedge Hysop (Gratiola officinalis). Root limbed and creeping; stem four to eight inches long, decumbent or oblique; leaves somewhat clasping, varying from lance-oblong to spatulate, and toothed, are dark green above, paler below; flowers composed of four petals, pale rose color in a yellow calyx; seed small, oblong, contained in an ovoid capsule; taste bitter, long enduring, nauseating; plant altogether poisonous, is capable of doing great injury, but proves a valuable medicine if judiciously employed.

The *Meadow Saffron* (Colchicum autumnale), plate 30, fig. 2, is a weed found abundantly in moist meadows; the last ornament of autumn, its pale red, crocus-like flowers may be seen raising their blooming heads above the brown and faded grass. Stem a span in length; leaves broad, lanceolate, and erect; plant a biennial, bearing seed the second year; seed-cell or capsule resembles the udder of a cow, wherefore it is often called the Cow's Udder plant. Often gathered by the country people for dyeing Easter-eggs; color a beautiful gray. Every part of the plant is poisonous, producing severe pain, gastric inflammation, and finally delirium and death. Milk, raw eggs, barley water, sugar, or other soothing demulcents are the remedies recommended to be employed in this case. ♂.

Dog's Parsley—Dog's Bane (Æthusa cynapium), plate 31, fig. 4. Leaves tripinnate and much dissected, resembling those of the common parsley; distinguished, however, by being glossy and of a darker green, but it is more easy to be detected by the nauseating garlic-like odor it sends forth on being rubbed. Root cylindrical, white, and branching; blooms in umbelliferous tufts.

Its poison operates like that of hemlock, therefore the same antidotes are proper.

Pasque Flower (Pulsatilla vulgaris) has a brown, branching, and fibrous root, radiating everywhere; leaves lateral divisions two-parted, middle one stalked and three-parted; segments deeply-cleft into narrow, linear, and acute lobes; dark green above, light green and pubescent below. Stem hirsute, bears a violet-colored flower, composed of six sepals, bell-shaped and rough on the outside, developed before the leaves. Akenes of fruit numerous, densely clothed with soft, silky hairs and provided with long, feathery tails, forming a tassel. Found in Europe on sunny slopes, also on the prairies of Wisconsin, etc. Receives its name because it is in bloom at Easter; is an acrid poison.

The *Agarick* (Polyporus laricis) has a cork-like, fleshy, smooth cap or hood with yellow and brown circles. Smells like newly-ground flour, and has a bitter taste. A drug used in physic and for dyeing. It is both male and female; the male grows on oaks, the female on larches. Is poisonous, but not deadly, although its operation is drastic and most distressing and alarming. Remedies the same; mucilaginous and demulcent drinks.

The *Deadly Nightshade* (Solanum nigrum). Native of Europe, where it grows abundantly; a somewhat shrubby and climbing plant; leaves ovate, wavy-toothed; flowers very small, purple, in umbel-like lateral clusters; berries globular and black. Grows on moist banks, rubbish-heaps, and in gardens. Its poison creates severe colics and deafness. Raw eggs, milk, etc., and, in some cases, bloodletting, are the usual remedies. ☉.

Black Hellebore (Helleborus niger). Radical leaves of this plant are lanceolate, from seven to nine-cleft,

and notched toward the points; flowers expanding, white, turns reddish when fading; stem about nine inches high, grows in southern Europe on the wooded mountains; sometimes, nay, frequently, planted in gardens. The root about as large as a finger, is black outside but white within; has an acrid, bitter taste. Poison virulent, very drastic, bringing on a general disturbance of the system, which, at last, terminates in convulsions and death. ℞. Leeches applied to the abdomen and mucilages with plenty of vinegar, are the usual remedies against the poison of Hellebore. The *Hellebore viridis* and *Hellebore fœtidus* are relatives. The following plant, is, however, of a different family.

The *White Hellebore* or *Sneezewort* (Veratum album), popularly known as Indian Poke. Leaves ovate, lanceolate, strongly veined and furrowed; the lowest nearly a foot long and about a hand's breadth wide; stem about three feet high, and pithy inside. Flowers numerous, green, in many axillary racemes, which, together form a pyramidal, terminal panicle. Root white and spotted, is said to possess active properties, and employed medicinally. Emetic and stimulant, but poisonous, it should be used with caution. When powdered, it causes violent sneezing.* ℞.

Water Dropwort—Cowbane (Œnanthe fistulosa), also called *Swamp Parsley*. Root long, fibrous; stem one to three feet high, erect, stiff, striate, smooth; radical leaves pinnately divided; leaflets three to eleven;

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* Our readers must not confound this with the common *Poke Weed*, or *Pigeon Berry* (Phytolacca decandria). The first belongs to the Melanthaceæ, which is generally pervaded by drastic, narcotic, and poisonous qualities, which are most powerful in Veratrum and Colchicum.—Wood.—*Tr.*

stem leaves simply pinnate. Flowers numerous, yellowish-red, umbelliferous, oblong. Fruit fleshy, globular, and greenish. Swamp Parsley is found everywhere in Europe as a marsh perennial; grows in swamps or stagnant waters. A coarse plant and very poisonous, the root particularly.

Water Hemlock or *Spotted Cowbane* (Cicuta maculata), found in the swamps of the northern states, and called *Musquash Root* or *Beaver Poison*, is a coarse plant with white flowers; very common. Root a deadly poison.

The *Ranunculus* or *Cursed Crow Foot* (Ranunculus sclerata) are coarse, creeping plants, with a knotty stem and yellow flowers, often called *Butter Cups*. Found either in wet places or neglected pasture fields, which they injure by spreading over the ground, and, like strawberry vines, rooting at the joints. It is therefore a difficult matter to eradicate them. All the ranunculæ (a large family, mostly of acrid plants) contain a poisonous juice, the operative element of which is fugitive and thrown off in boiling; therefore, as they are seldom eaten without being cooked, cases of persons being injured by them are extremely rare. They are almost universally poisonous to sheep, and the species we have just been describing, is particularly so. The stem of the Ranunculus sclerata is one foot high, rigid and many-leaved. Leaves three-lobed; flowers small and pale-yellow; juice blistering; is an acrid narcotic poison. Found also in America in marshy grounds. 2f.

The *Hog Mushroom* (Boletus luridus). Stem fleshy, rather swelled at the base; hood or umbrella vaulted and cushion-like, leathery, and of various colors, whitish or pale-yellow, grayish-green, olive, brown or bright red.

The sporules produced at the free summit of the cells are at their openings of different shades of color, varying from vermilion to purplish-red. Found singly, mostly in thickets or under hedges, in woods, etc. An acrid narcotic poison, very drastic in its operations, creating inflammation of the stomach and bowels.

The *Hemlock* (Conium maculatum), plate 31, fig. 3. Stem smooth, branching, reddish-brown and spotted; leaflets lanceolate, pinnatifid; root turnip-shaped, single, branching, white; height about six feet; distinguished partly by its brown spots, and partly by the peculiarly dark green color of the leaves. Tastes exceedingly disagreeable and smells worse; its effects are stupefying. At first excitement attended with headache, and soon after followed with severer symptoms; the fatal symptoms of its operations become every moment more apparent. Difficulty of swallowing, loss of sight and hearing, coldness and paralysis of the extremities come next, and, last of all, convulsions and death. This plant is the more dangerous as its root is so like that of the parsnip that it may readily be mistaken for it; planted in a garden, it loses its spots and then resembles parsley, nevertheless the seed can easily be distinguished from that of the latter as it is furrowed transversely. The same remedies used as recommended in poisoning by the agarics, namely, mucilages plentifully mingled with lemon juice or vinegar. ♂.

Spurge Laurel (Daphne mezereum) is a small bush; leaves lanceolate, deciduous. arranged in terminal tufts; flowers beautiful pink color, sessile; about three are produced from each lateral bud; very fragrant; berries bright red. A beautiful European shrub; blooms in February. Found in the mountain forests. The whole

plant, but especially the bark, is an acrid poison, and so penetrating, that smelling a flower will cause inflammation of the nostrils. The berries are very dangerous, if eaten, very drastic and creating cramp of the stomach. The same treatment recommended for other vegetable poisons, milk, raw eggs, etc., is proper. ♃.

The *Savin Tree* (Juniperus sabina), a slender, evergreen shrub, arboreous, sending out numerous horizontal branches, growing from eight to twelve feet high. Root woody, consisting of one strong, radical spike; wood of trunk red, fine-grained, and very hard. Leaves spicate, resembling sharp-pointed needles, dark green above, blue-green below, angular, channeled on the mid-vein above, heeled below; arranged in whorls of three to five to eight seconds on the ends of the twigs, they give the tree a beautiful appearance. Flowers very small, seated in terminal aments; the fertile in oblong catkins. Fruit small, round, bluish-black berries, ripening the second year. Grows wild, but often planted in ornamental grounds for sake of its beauty. The whole shrub, but especially the leaves, has a disagreeable aromatic odor and an acrid spicy taste; any portion eaten is poisonous, producing inflammation of the bowels and other distressing effects. Horses eat it eagerly, but if for any length of time in excess, it is said, it operates as a poison on the skin, and causes the hair to fall off. It is useful, and often employed to be packed among furs or woolens, to keep away the moths. ♄.

The *Thorn Apple—Jamestown Weed* (Datura stramonium), plate 30, fig. 6, branched, spreading; leaves large, smooth, with long, irregular teeth and sinuses; flowers bluish-white, solitary, campanulate; fruit egg-shaped, the size of a small apple, and covered with

spines; seeds black, rough, dotted, somewhat like flax-seed. Stem two to four feet high; both herb and seeds are powerfully narcotic poisons. Children are apt to be attracted by the flowers and thorny apples, therefore, the plant being common, it is highly important that every one should be made acquainted with its dangerous properties. Symptoms of its effects are, great anxiety, tremor, difficulty of breathing, dizziness, palsy, delirium, and death. Emetics and acidulated drinks are the popular remedies. Being powerfully narcotic, it is itself a potent medicine; used with certain restrictions, is useful in asthma, etc. Said to be a native of America, but is, most likely, of Asiatic origin. ☉.

Tobacco (Nicotiana tabacum), leaves lance-ovate, decurrent; stem clammy, three to six feet high; flowers greenish-yellow; corolla bordered with rose color, standing in terminal panicles. The whole plant has a disagreeable, stupefying odor and nauseous, acrid taste. Native of Central America, Tobago, and the Province of Tabasco in Mexico, it was taken to England toward the end of the sixteenth century by Sir Walter Raleigh, by whom the practice of smoking this pernicious weed was first introduced. As its first use, whether smoked or chewed, produces a deadly sickness, it was only after repeated and painful trials that it at last became tolerated, first as smoked or chewed, and lastly in the form of snuff. The habitual use of tobacco is always, more or less, injurious to the system, especially to the nervous system. Smoked, it soothes or quiets the nerves of the stomach; consequently the appetite for food is lessened; employed as snuff, it excites or exhilirates another set of nerves, but in each case equally deleterious. Sailors use it to keep off scurvy. Taken into the stomach, it is a power-

fully acrid narcotic poison, creating nausea, emesis, etc., spasmodic cramps and convulsions. ☉.

The *Taubling* (Agaricus integer) is from one to two inches high and a half or quarter of an inch thick; stem smooth, slightly bent, thicker below than above, whitish, running into red; cap or umbrella closing from above, concave in the middle. Is of all colors, and one to five inches in diameter. Leaf white or of a pale foul yellow. The young boletii are tender, the old hard and inedible. Found everywhere in Europe from August to September, spring up after warm rains among moss and leaves in dry places. Sometimes they can be eaten with impunity, at others, however, they are very poisonous, and in their effect resemble the hog mushroom.

Darnel, also called *Tare*, *Cockle-weed* (Lolium temulentum), plate 31, fig. 7, and in the German *Schwindelhaber*, because it produces intoxication, belongs to the Graminæa. Flowers numerous, seated on obtuse, compressed spikes, fringed with beards; grows among grain, particularly oats; leaves sharp on the edges. Creates giddiness of the head and a species of sleepy drunkenness, wherefore unprincipled brewers are in the habit of putting the seeds in their beer in order to increase its soporific effect. Seeds rough and black, when abundant in wheat are injurious to the quality and appearance of bread made from the flour. Emetics and acids, as previously recommended, are antidotes to its poison. ☉.

Belladonna (Atropa belladonna), German *Mad Apple*, plate 30, fig. 1, is an herbaceous plant, five to six feet high; leaves naked, ovate; root turnip-like; flowers dull dark red, and the berries glossy black, are filled with purplish-red juice and light brown seeds. Every portion of this plant is poisonous in the highest degree. The

odor has a stupefying effect and the leaves a bitter taste. The berries being sweet, are, on that account, particularly dangerous to children. The consequences of poisoning by Belladonna are, anxiety, headache, distressing thirst and fever. It has a peculiar effect on the eyes and throat, the pupils become unnaturally dilated, the latter swells so that swallowing becomes difficult and soon impossible. Stupor, palsy of the extremities, wandering of mind next ensues, and lastly death. Emetics are proper; their operations assisted by the application of mustard to the stomach. Cooling, astringent, and mucilaginous drinks are also recommended. 2f.

The *Water Hemlock* (Cicuta virosa), plate 31, fig. 1. Stem two to four feet high, smooth, finely channeled, jointed and branching above, lower leaves triternate, quinate; leaflets or segments small and finely toothed; grows in margins of swampy rivulets. The mature fruit has a strong, anisate odor, resembling that of celery; taste, however, is very different, being acrid and bitter. Root turnip-like and very poisonous, and the lives of children and others are often endangered and even destroyed by eating it in mistake for that of the sweet cicely. Effects much resemble those produced by Conium maculatum, only the poison, more virulent and deadly, consummates its work of death more rapidly. Remedies the same as recommended in the treatment of poison from Conium maculatum. ⊙. The herbage is also said to be destructive to cattle.

From the short sketch we have given of the vegetable kingdom, our readers may see how many varied and important services are rendered to us by plants. A great many of them afford to man wholesome and abundant food; others, as has been shown just above, are violent

poisons to him, but even those are made subservient to his uses, because, when judiciously administered, they constitute powerful medicines. Much that is interesting might be said on this subject, but we have not the time, nor is this the place, as perhaps some of our readers may be disposed to think we have been rather prolix in our descriptions of poisonous plants. Let us, therefore, close our sketch of the Vegetable Kingdom with a recommendation of the study of Botany, which is an important one, inasmuch as extended among the people, it will enable them to understand and avoid and extirpate the evil, and turn that which is most noxious to useful and benevolent purposes.

MINERALOGY.

THE science of Mineralogy is that which treats of the inorganic substances existing in and composing the earth's crust—mountains, rocks, ores, and earths. The study of these various substances, and the mineral masses they contain, belongs particularly to mineralogy, but the study of their mutual relations, and the nature of the materials which constitute the structure of our globe at present, is the province of geology. In the first respect it is mineralogy in particular; in the last it is geology (from the Greek, *ge*, the earth, and *logos*, a discourse), or that branch of natural history which treats of the structure of the earth's surface, and the forces by which it has been modified to its present form. We will, therefore, commence by sketching the principal features of geology, and afterwards give a more detailed description of the subjects lying within the particular province of mineralogy.

THE PRIMITIVE FORMATIONS OF THE EARTH.

All the inorganic substances which we find upon the surface of the earth, present one common feature, namely, that one and all have been produced by igneous action, or in other words, by the influence of fire. All the rocks,

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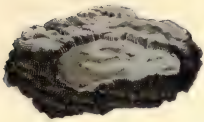

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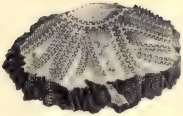

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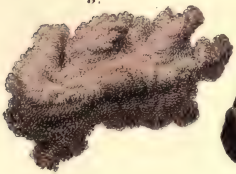

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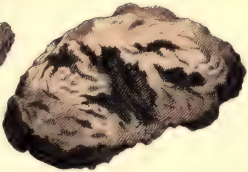

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earths, water, and air* have evidently been subjected to the action of a severe process of ignition before they assumed their present form. This brings us, therefore, to the conclusion that the earth, at some remote period, was a liquid mass, melted by heat, which gradually became cooled, and many appearances now met with seem to demonstrate that the center of the earth is still in a state of constant fusion. The only exceptions from the general igneous process are the noble metals.

Accordingly, then, as by the action of this burning process not only the earth, but also water, was formed, we may reasonably be led to suppose that at that time the earth appeared as a large ball or globe, whose surface, unmarked by any undulations of hill or valley, was covered with thick mud, and from which was produced the aquatic plants and animals whose fossil remains are found entombed in the rocks and different strata which compose the earth's crust. This physical condition of the surface of the globe, which must have continued for many centuries, has undergone great and numerous changes, as is altogether evident from the order of the superposition of the different strata of *formations*, supposed to be the effect of fearful volcanic eruptions, which have raised up the solid crust of the globe, and causing the dry land to be lifted up above the waters, formed islands in different places, as may sometimes be seen in the present day. These islands formed the first firm land,† and most probably gave rise to a new flora and a new population of animated creatures, whose fossil remains, found in the different strata, as those of amphibia, mammals, birds,

* By the term *mineral* is meant any inorganic object, whether solid, liquid, or gaseous.

† *Feste-land*, Germ. (Continent).

etc., not only prove characteristic of the different periods at which they have existed, but also prove the truth of those great geological convulsions which have brought the earth to its present form. Through the repetition of these volcanic eruptions, at different epochs and in unequal intervals of time, the firm land gradually separated more and more from the water, although it does not appear that genuine mountains as yet existed; but (as geologists say), that the earth's crust, remaining for a long time, at first, in a soft or pasty condition, gradually cooled and became hard, partly by the action of the air and partly by the operations of its own internal agents, as exhibited in volcanic disturbances; it solidified into masses, and formed what the German geologists term *Flotzgebirge*, Germ. (stratified mountains), primary rock formation.*

As each of these stratified formations present us with the traces of the existence of living beings peculiar to the different epochs at which they lived, we have come to the conclusion that at each geological convulsion these animals must have perished by some sudden catastrophe; and not only is this supposition educed from the positions in which they are found entombed as in the very act of moving, but also that the hard portions of the original structure, such as bones, shells, etc., altered in

* The word *rock*, as used by geologists, is applicable to all mineral masses, and includes in its meaning sand, marble, clay, granite, etc., that cover the solid parts. Comparing the different materials comprising the earth's crust, as found in examining the excavated side of a mountain, the observer will very soon perceive that there are a great many different formations, and that these layers or stories are in layers or stories reposing one above another—(plural of *stratum* a Latin word, meaning a bed, couch, or layer).—Ruschen. Geology. —*Tr.*

their nature, and passed into the fossil state, and having undergone an alteration into stony particles, preserve the skeleton entire, showing no dislocations or other marks of injury, which would contradict the generally received opinion that death had overtaken them in some sudden revolution.

From a configuration of the sedimentary, and particularly the primary or stratified rock formation,* in which no fossil remains of organic bodies are found, it has been inferred at this epoch—the first geological—no living beings existed on the surface of the globe, and that until the fourth epoch,† in which space man was created, the earth was (as described in the Mosaic record) without form and void, an extended plain, the dry land raised but little above the surface of the sea, and consisted mostly, it is supposed, of muddy ground. A thick crust of rocks, minerals, and earths, melted into a liquid mass by the action of its internal heat, and kept in a state of constant

* The Sedimentary Formations are those which are deposited by the action of the water and stratified. The primary or stratified rocks are those in which neither organic remains nor fragments of the most ancient rocks are found. This group includes gniess, mica-schist, quartz, transition schist, limestone, etc.—*Ruschenberger.*

† The organic creation is divided into four successive and also rational epochs. The first established *vegetative life,* or life of nutrition. which is manifested not only in plants, but also in the inferior animals, in which we find scarcely any other phenomena than that of nutrition, growth, etc. Afterwards came the *life of relation,* or sensibility, instinct, intelligence, and will, successively added, in different proportions, to the phenomena of simple existence. This new life first takes a certain development in fishes (including reptiles no doubt); then birds, which, together, constitute the second epoch of creation. It acquired a new extension in mammals, which appeared at a third epoch, and finally reached its highest degree in man, with whom terminated the work of the Omnipotent, receiving a soul in the image of God, to distinguish him from all other creatures.—Ruschen.—*Tr.*

fusion, enveloped its interior portion; but this condition was not to continue. All at once—and it is presumed it was but the work of a moment—at the command of the Creative Power, the scene was changed. The mighty elements began to operate, producing the great upheaval of the internal igneous masses, pressed upwards upon the sedimentary and stratified formations already existing, forced them out of their original beds or from their ordinary position, as may be plainly discovered by examining the strata exposed by excavation. A very simple illustration may give the reader an idea of such an upheaval, if he will imagine the leaves of a book lying superposed in a horizontal position, and pressed upwards with irresistible force by some powerful agent below how each separate leaf will be dislodged, twisted, and wrested from its original position, and at last torn asunder by the protruding force acting beneath them, in the successful effort for freedom. The escaping mass forms the granite or massive rocks seen in the primary rock formation, which term includes all the loose materials—soils, clays, gravels —substances which were previously in a state of fusion.

How those upheavals have originated is hard to tell. Perhaps the most plausible explanation is the following: The earth, which, as is well known to all, turns upon its own axis, before the time of the first upheaval performed its rotatory motion more rapidly than at the present; that suddenly the rate of its diurnal revolution was reduced to its present measure, therefore, if this theory is true, it may be supposed that those heavy masses of stone or mineral materials, either wholly or partially in a state of fusion, which we now call primitive rock (granite, which seems to form the foundation stone of the great geological edifice) might be able, by the indwelling centrifugal force

to raise up the surrounding superposed strata, force its way by a partial explosion, and now the vast quantity of liquid matter overflowing and oscillating from side to side, could emboss it with those igneous masses, which, on cooling, became rocks. The following may also be imagined: A body revolving swiftly on an axis, becomes hotter and hotter, according to the rapidity with which it is turned; but let the velocity be checked suddenly—a cooling process at once begins. This was also the case with our earth in the earliest antediluvian period; the incandescence or liquifaction gradually cooled down, and continuing after the upheaval, which caused the primary rock formation, the great ice period ensued, and is supposed to have continued for many centuries, the remains of which are still occasionally met with.

It may be imagined that at the time of the ice period the greater portion of the earth's surface was covered with ice. Gradually, however, the imprisoned waters melted, and accomplished great and remarkable changes on the face of the earth. In the large masses of water which now covered the surface of the earth, many whirlpools and torrents of fearful power were produced, which, tearing away and removing all parts fractured by the upheaval, forced their passage through all obstructions, and formed the valleys, ridges, and other configurations, of which there is palpable evidence at the present day. For instance, on the opposite slopes of great ravines, which those fiercely running waters have excavated in their headlong course, the same course of stratification is observed to exist unaltered, except where some volcanic eruption has come in the way, and disturbed the general law. In the low-lying regions of the earth, where the depression of the surface is greatest, as Middle Asia, the

Desert of Sahara, and in Europe, the Mark of Brandenburg, are found immense masses of sand, supposed to be the disintegrated portions of rocks carried there by the transporting power of water; and so great is its power of moving heavy substances, that even at the present time, in the low-lying plains of Brandenburg, East Prussia, and Russia, very large blocks of granite, embedded in ice, are found deposited there, transported in this way far from the places of their origin or point of departure. It is impossible that these masses of rock could have been carried there or kept afloat in any other way than on ice cakes, which, as the velocity of the current lessened, on reaching the level ground, were deposited there. Animals and plants, embedded in similar icebergs, have been carried by the same transporting power to portions of the earth most remote from their original homes; for instance, trees or branches of the palm family, natives of the far East, have been met with in the iceblocks of the German Alps, and animals of the antediluvian genus of elephants have been found in the ice-fields of Siberia; their fossil remains uninjured by the friction or obstacles met with in removal.

The Glaciers, those beds of ice occupying the high valleys of lofty mountain chains, as well as the ice-fields of Siberia, and the so-called polar ice, are but the remains of the great ice period, which has had much agency in producing the present form of the earth. Granite and some other unstratified rocks which were considered to have formed the foundation stone of the great geological edifice, it is now admitted, do not all date from an antiquity so remote, but are in reality younger than the stratified or primary rock formations. Of still more recent date are the unstratified or igneous rock forma-

tions, which owe their origin entirely to volcanic agency, and are found in heaped-up fragments everywhere on the surface of the earth. Basaltes are evidently traceable to craters of subterranean volcanoes, having arisen from them in the epoch of their activity, and bursting through all opposing matter, formed thick deposits, which, on cooling, exhibited large heaps of lava-like substances, forming isolated masses, as bosses, hillocks, or regular columnar shapes, divided into prismatic pillars.* The Palisades on the North River are examples of basaltic columns.

From these statements, it is therefore plainly deduced that the primitive formations of stratified and unstratified rocks were originated either by upheaval or depression of the earth's crust, by the action of fire, or formed by sedimentary deposits left by the moving mass of waters, which, as above stated, in their headlong course, excavated valleys, formed hills of alluvial detritus, and, producing great changes, finally left its effects on the surface of the earth, as is everywhere apparent at the present day. These are called primary (stratified) rocks. Those which, in the earliest antediluvian period were formed by upheaval or owe their origin to the exploding force of volcanic action, escaped from the bosom of the

* De la Beche divides all rocks into two great classes, Stratified and Unstratified. The latter he treats as a single family; the former he subdivides into ten groups. (See De la Beche's "Manual of Geology," p. 38. Lyell's first class embraces only alluvium, and is called *Recent;* the second contains, and is named the *Tertiary,* diluvium being included in the upper part; the third class he denominates *Secondary,* which extends to the bottom of the old red sandstone; next, succeeds his *Primary Fossiliferous Class,* which includes all the remaining fossiliferous rocks. His *Metamorphic Rocks* embrace all the stratified non-fossiliferous groups. The unstratified rocks are

earth in a state of fusion, resembling great masses of melted porcelain, glass, or metals, became solid by cooling, but without being stratified. These are called massive or unstratified rocks.* The several formations are divided into the following classes and orders:

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distributed through these several classes, and he has likewise made a division of those unstratified rocks that exist below the stratified ones into *Primary Plutonic, Secondary Plutonic, Tertiary Plutonic,* and *Recent Plutonic,* reckoning in a descending order.—Lyell's "Principles of Geology," Vol. 2, p. 504.—Rozet, in 1835, divided all rocks into two great series, viz., *Stratified* and *Unstratified* rocks. His first series he divides into six geognostic epochs, the first embracing alluvium, the second diluvium, the third the tertiary strata, the fourth the subjacent rocks as deep as the coal measures, the fifth the remaining fossiliferous rocks, and the sixth the non-fossiliferous stratified rocks.—"*Traite Elementaire de Geologie,*" *par* M. Rozet.—As our book is from the German, and intended for the use of American readers, we beg leave to make the following observation on the geology of that country. The south-western and eastern borders of Germany consist of lofty mountains of primitive rocks, which occur also in several places more central, as in the Hartz Mountains. Secondary rocks occur in many places, though relatively less abundant than in Great Britain. Yet nearly all the fossiliferous rocks of Great Britain are found in Germany, and in the same relative position. A part of the extensive plains of North Germany is composed of tertiary rocks, covered with diluvial detritus from Scandinavia. As many as four other tertiary basins occur in Germany. Indeed, nearly every stratified rock that has been found in any part of the world exists in Germany. It is also rich in ores and mineral substances of every kind, and it is the most remarkable country in Europe for the extent of its mining operations and for the scientific skill with which they are conducted.—Hitchcock's Geology.—*Tr.*

* As the various formations constituting the common portion of the globe differ so widely in their nature, in their constitution and mode of arrangement, some produced in the midst of the waters, "by the deposit of solid materials held in suspension or in solution by this liquid, and others by the action of heat on earthy materials susceptible of being melted and of being afterwards hardened by cooling,"

FIRST CLASS.—PRIMARY OR STRATIFIED ROCK FORMATION.

First Order: Transition Rock Formation.—Sedimentary.
Second Order: Tertiary Rock Formation.
Third Order: Secondary or Unstratified (Floetzgebirg—Flat Rock) Rock Formation.
Fourth Order: Diluvial and Alluvial Deposits.

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geologists have divided them into two great classes, namely the *Sedimentary* or *Stratified Formations* and the *Massif* or *Igneous Formations*. On account of the presumed method of their production they are also designated under the names of *Aqueous* or *Neptunian Formations*, and *Igneous* or *Plutonic Formations*. The first, which was the theory of the celebrated Werner, affected to prove that the present appearances of the globe may be traced, with the exception of volcanic products, entirely to the agency of water, to aqueous solution, disintegration, and deposition, and are termed *stratified formations* and most of them *sedimentary formations*. These deposits formed a variety of crystalline aggregates, such as granite, primitive, slate, and limestone, and constitute the primary rocks, supposed to have had their origin at the earliest geological epoch. The second class of rocks is supposed to have been formed during the transition of the earth from its chaotic to its habitable state, and are called *transition rocks*. The third class of rocks is supposed to have been formed by the action of the natural elements on these, and by which they have been broken down and mechanically diffused by water. The action of frost, water, and attrition are supposed chiefly to have produced this effect, after which the materials were deposited in horizontal strata. These are the *Floetz* or flat rocks of Werner, and the *tertiary* or secondary rocks of later authors. They abound in vegetable and animal remains. The Plutonic rock formation is attributed to the agency of fire, not entirely rejecting that of water. According to this theory the materials which compose the present surface of the globe, have been derived from the ruin of ancient rocks which have been disintegrated and pulverized by the continued action of water, and transported by the same means to the bottom of the sea. Here they have been consolidated partly by time and partly by the pressure of the water, but chiefly by the effects of subterranean heat. By the expansive power

SECOND CLASS.—MASSIF OR IGNEOUS ROCKS.

First Order: Primitive Mountains.—Stratified.
Second Order: Basaltic or Volcanic Rock Formations.*

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of volcanic heat, the strata thus formed have been elevated from the bottom of the ocean to occupy the situations under which they now appear. Thus the strata are thrown into different degrees of inclination to the horizon, or are broken and dislocated, or appear in nearly a vertical position, depending on the degree of force or the power of its application. Sometimes when the heat has been most intense, an entire fusion of the materials has been effected. The rocks which are not stratified, or not composed of layers, as granite, are supposed to have undergone complete fusion, while those which consist of layers, as mica slate, are supposed to have been softened by the heat.—Brande's Outlines of Geology.—*Tr.*

* The most simple division of rocks is into Primitive or Primary, and Secondary. The first consisting of those which are supposed to have been originally formed, such as granite and its associates, and the second such as were formed by the disintegration or destruction of these. In the first kind no organic remains, as plants or shells, are found, and hence they are supposed to have been formed before the creation of organized beings. In the Secondary, these remains often exist in great abundance. To this classification the celebrated Werner added the Transition Class, which consists of the larger fragments of the Primitive, and which is intermediate between this and that usually called Secondary. The following classification is perhaps the simplest, and being without minute subdivisions, will be most easily understood:

I.—Primary.
II.—Transition or Intermediate.
III.—Comprising,
a.—The Lower Secondary Series.
b.—The Upper Secondary Series.
IV.—Tertiary.
V.—Basaltic and Volcanic Rocks.
VI.—Diluvial and Alluvial Deposits.

FIRST CLASS.

PRIMARY STRATIFIED ROCK FORMATIONS.

FIRST ORDER.

TRANSITION FORMATIONS OF MODERN TIMES, COTEMPORANEOUS WITH THE EXISTENCE OF MAN ON THE EARTH AND STILL FOUND.

By the term *Primary Rock* we understand all formations from drift, transport, alluvions, etc., which compose the exterior strata of spongy or loose soil found on the earth's surface, whether on the extended plain, deep valley, or covering the bottom of lakes.

The stratified rocks bear evidence in every part—in their regular layers, their worn sand or pebbles, and their fossils, that they are the results of gradual accumulations beneath waters, marine or fresh, or on the shores of seas, lakes, and rivers.

The organic remains of creatures belonging to species yet existing, which, not exactly fossil, but half decayed and partially burned, mingled with empyreumatic substances are often found deeply hidden within its structure, and utensils of different kinds, and weapons of war, etc., the relics of remote early times are also met with in the excavations attending the improvements pursued at the present day. By the influence of the atmosphere or weather on the primary stratified formations, causing degradation of certain portions soluble in water, and carried away by floods, torrents, volcanic ejections, etc., all contribute, by forming sedimentary deposits, to continually form, renew, or maintain the structure of this formation. We shall first, in describing this class, name

Alluvium or *Vegetable Earth*, which is a combination of different earths or soils, varying according to circumstances or position. Mostly it is composed of a mixture of sand, clay, and marl, but is also very often formed directly by the disintegration of other formations, and their mixture with the products of decomposition of other plants and animals, spread in a layer of more or less thickness, over the surface of the earth is called *Humus*. Wherever this deposit is found abundantly, the soil is eminently fruitful.

Turf Moors or *Peat Bogs* are found in different excavations of the surface in valleys or low marshy situations, where stagnant waters constantly exist. All aquatic plants, such as *Duck-meat* (Lemma), cresses, etc., contribute to the formation of peat, as well as terrestrial plants brought to these bogs by brooks, and, being submerged, gradually become decomposed, and form a single accumulated mass of what seems black earth. From this soil spring various other plants, which, in their turn die and also become decomposed, particularly as the water partially dries away. Frequently trees or large plants which grow on the borders are found buried in the mass, particularly in the lower part, where they accumulate on sands and clays found on the bottom, or, mingling with the *humus*, compose a web of fibrous tissue, which forms the combustible substance known as *peat* or *turf*. These peat-bogs, when exhausted, if left undisturbed for a few years, are sure to renew themselves by a similar process to that already described.

Coral Reefs.—These formations of stony polyparia are the framework formed by coral animalculæ, and cemented together by calcareous matter. The polyparia continue

to build in many branchings until the ridge reaches to the surface of the sea at low water, after which the sea washes upon it fragments of coral, driftwood, sea grass, portions of stranded ships, etc. These substances decompose and form soil, which gradually accumulates, and, as the sea birds flock there in great numbers, the seeds transported by them from other climes spring up, and aid in forming islands which are at length occupied by animals, with man at their head.*

Calcareous Tufa or *Travertin* is a deposit of carbonate of lime formed by depositions of water from springs containing that substance in solution. The concretionary deposits found depending from the roof of caves are called *Stalactites*, the portion encrusting the floor *Stalagmite*. The first is formed by the percolation of water through limestone rocks, and the calcareous particles which were dissolved and subsequently left on the roof of the cavern by the evaporation of the water. Stalactites assume many grotesque forms, but mostly hang like icicles, and gradually increase by the further deposition of stony particles, in concentric rings. Sometimes the stalactite and stalagmite meet, and, joining, form pillars extending from the floor to the roof of the cavern.

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* A chain of coral islets four hundred and eighty geographical miles in length has long been known as the Maldives. Volcanic agency, also, often lifts the reef far above the waters. Great masses of Guano, often extending many fathoms deep, are found in these homes of the sea birds. A well known fertilizer of soils, guano has now become an article of commerce, and is brought from the coral reefs of the South Sea, where sea birds have congregated unmolested for centuries uncounted.—See LYELL'S GEOLOGY, p. 172.

SECOND ORDER.

TERTIARY ROCK FORMATION.

The *Tertiary* or *Third Formation* was deposited after the secondary, and may be considered as being made up of the disintegration of the two foregoing series, namely, by silicious limestone or fresh water chalk, together with sand, clay, and marl. The tertiary strata contain a great number of fossil remains analogous to or identical with species still existing, and also gigantic specimens of a race of quadrupeds long since extinct. Fossil shells, fragments of wood, the remnants of primitive forests overthrown by volcanic agency—the latter often found embedded in the Brown Coal Measures—bones of fishes, crocodiles and other reptiles, of birds and even of quadrupeds, such as apes, hyenas, bears, etc., the latter being isolated and often entire. The mention of these remains of animals belonging to genera still existing but the species of which is now lost, induces, in this place a consideration of

The *Bone Caverns* found partially in this formation and partially in the earlier formations, remarkable for the number and variety of bones they contain of animals mostly of races belonging to the earliest times; they appear to have been destroyed in the geological revolution which upheaved the Alps and gave its present form to Europe. These caverns seem to have afforded a resting-place to many varieties of animals that frequented them as suitable spots for devouring their prey, or finally came to them to die. Deer, horses, oxen, hyenas, wolves, dogs, etc., all seem to have congregated in those subterranean abodes; can it be assumed that they dwelt in

peace together, and went forth in companies to hunt their prey, or were they the prey of others who devoured them there? However this may be, their bones accumulated through a great many generations, and the fossil remains of their dejections prove that these caverns were permanent rather than temporary resting-places for them.

The most remarkable are those of the Hartz, Franconia (in the latter is the bear cavern of Galenreuth), Muggendorf, Hohlenstein, Erpfingen, Adelsberg, and Kirkdale, in which last named the bones found were proved to have belonged to twenty-three genera.*

THIRD ORDER.

SECONDARY ROCKS (*Floetzgebirge*).

This formation, which, with the exception of the primitive rock formation, constitutes the great portion of the so-called mineral earths of which our mountain ridges are composed, consists of numerous and plainly developed strata of chalk and sandstone superposed in alternate layers. It contains a great number of organic remains in a perfected fossil state, which evidently belong to an antediluvian period. Few of these "medals of Creation" present vestiges of mammals, but the remains of numerous mollusks, from the gigantic Ammon's horn to the smallest gryphite. Amphibia are

* Professor Buckland supposes that this cave was a den of hyenas, and that the multitude of bones found there were carried into the cave by these animals, and therefore that the hyena, an animal now inhabiting only the hottest climates, once lived in England.—See RELIQUE DILUVIANÆ, p. 37.—*Tr.*

also found, although not frequently, but those that come to light are of immense size; and also in this formation belong those singular Saurians whose skeletons remind the observer at once of fish and lizard. The fossil plants found in this formation, of simple structure but immense size, belong mostly to the genera of *Equisetacea*, or horse-tails, ferns, or sedges. The secondary or rock formation is divided into three great portions, namely, the *Cretaceous* or *Chalk*, the *Jurassic* and *Trias* formation. We will proceed first to examine that assemblage of rocks which were deposited or derived from the interior of the earth at the particular geological epoch in which chalk was deposited, and called

The *Cretaceous* or *Chalk Formation.* This structure, evidently formed by marine agency, is composed of cretaceous matter, or chalk resting on a basis of sandstone. Calcareous Tufa (Spar) or Carbonate of Lime, is a friable, chalk-like substance, of a yellow or grayish-white color; in some locations found so soft that it is reduced to powder by merely atmospheric influence, but in others it forms a solid limestone, of so firm a structure that it is used for building purposes. Among several varieties we will only, in this place, notice a few.

Chalk, or *White Granular Limestone*, is mostly yellowish-white, but is often also found of a reddish hue, and is then of a firmer structure than the commercial article known as chalk. It contains a considerable portion of flint, and forms the white chalk cliffs on the shores of England, whence that country receives the name of Albion. Occasional strata of Gypsum (Plaster of Paris) and Rock-salt occur in the cretaceous formation; the first is found at Segeberg, in Holstein, and at Leineberg, in Hanover, and the last in Catalonia.

It contains the fossil remains of mollusks in great numbers and variety.*

The Jura Formation.

The assemblage of sedimentary rocks, to which has been given the name of the *Jurassic Formation*, compose the foundations of the Swiss and Suabian Alps, and form the most remarkable strata of the Jura. The first of these layers which claims our observation is the calcareous matter or structure called coral chalk, or *coral rag*, which is a great porous net-work, composed of *coralliferæ*, which belonged to an antediluvian world, and are remarkable as forming numerous cavernous fissures or structures, which often contain mineral treasures. We shall mention a few of the most important.†

Bohn-ertz—Bog Iron Ore—Limonite, a loose, earthy ore; is found in veins, or arched beds, and often represents large globular masses, containing, although mixed with much silicious earth, two-thirds its own weight of pure iron. Occurs connected with rocks of all ages, but is mostly found below the tertiary rocks; however, in many parts of the Suabian Alps it lies so closely beneath the upper surface as scarcely to be concealed.

Oolite, also called *Roestone*, because it is composed of small globules resembling the roe of fishes, is of a light brown or whitish-ochery color, seldom gray, but sometimes blue; a variety of common limestone, usually found in the conformable position of strong stratifications,

* The greatest deposit of Gypsum is that of Paris, and extends twenty leagues. It is noticed as singular that, throughout the extent of the two Americas, not a specimen of chalk has been found.

† See Macculloch on Coral Formations, vol. i. 337.

in banks superincumbent on chalk beds, frequently mixed with Kalkspath* and Hornstone. The globules composing it are sometimes very minute and fine, at others, coarse and granular. Peastone or Pisolite differs only from Oolite in the larger size of its particles, which are composed of concentric laminæ.

Iron Roestone, also one of the Oolitic group, composed of chalk and marl, is rough, of a bluish-gray color, and consists of sprinkles of lenticular globules, containing much iron; it is also called *Clay Ironstone;* very hard. Found largely in Germany, Poland, and Russia.

Lias—Gryphite Limestone—(Magnesian Limestone of England), consists of dark-colored strata or layers, in which an argillaceous character (nature of clay) predominates, but is also remarkable for a quantity of calcareous matter mingled with the clay, and particularly distinguished by the fossil remains of numerous Gryphites.

Lias Sandstone, is a yellow and brown sandstone, found in alternate layers with limestone and marl. Both of these strata contain bitumen and naptha, which flows through them; pyrites, bisulphuret of iron, and sulphur springs are also present in this formation. This bituminous fluid, also called *animal oil*, found in the Lias strata, is of great importance at the present time, and useful in the manufacture of gas, being supposed to be the product of millions of perished marine animals, whose oily portions are now used in this form to light up our chambers and our streets. Naptha affords both fuel and light to the inhabitants of Badku, on the Caspian.

Jura Dolomite, or *Bitter Spar*, is remarkable as con-

* Calcareous Spar.

taining a considerable quantity of bitter earth, and for its wonderful conformations, which claim the admiration of every beholder, as presented in the various shapes of rocks, castles, walls, pillars, and ruins of old towers, and mountain fortresses. Used for many purposes, on account of its water-resisting nature, hardening when immersed. It serves principally, however, for making mortars or molds.

III.—Trias Formation. (*Upper New Red Sandstone of the English Geologists.*)

The *Trias Formation*, now about to be described, is distinguished by a deficiency or poverty of the lime or chalk principle, with the single exception of Muschelkalk (Shell Limestone). The Trias system of the French and German geologists, so named because it is composed of three kinds of rocks, is supposed to be constituted by new deposits formed around the base of the hills after the elevation of Vosges, Black Forest, etc., by geological convulsions, which occurred after the previous formations we have partially described. The stones of this system are made up of clay and sand, and mostly of a red color. The most important specimens are, first,

The *Keuper Sandstone*, with Marl. Resting directly above this species of rock is found another strata of sandstone, which is white, coarse-grained, soft, and so easily pulverized, that it is used for various domestic purposes. To this succeeds marl (argillaceous carbonate lime), found in successive layers between the sandstone, and is of blue or red color; next comes the genuine Keuper Sandstone, which furnishes excellent building materials; sometimes it is red, at others greenish-white. Distinguished by

geologists as a group of sandy marl, and remarkable for numerous fossil vegetable remains, mostly those of the Equisetum (Horse-tail) and Reed families. A kind of carboniferous clay or limestone is occasionally met with in this formation, but is little valued.

Variegated Marl, with Gypsum frequently found interstratified with the upper layers, is composed of indurated clays of various colors. Gypsum is found in separate strata; is mostly red, but sometimes, although rarely, white as alabaster.

Letten-kohle, Germ., *Clay Slate Coal.* Lying under the lowest strata of the Keuper Sandstone, and easily recognized by its light gray color, this species of coal is found in company with marl, gypsum, and alum-slate. It is impure, clayey, fissile, and, in coming in contact with the air, splits off into laminæ; occurs only in schistose strata, and can not be used for burning.

Muschelkalk—Conchylian Limestone—(shell-chalk) lies under the Lettenkohle marls in strong layers, which represent huge, compact masses of limestone; is of a dull gray or dark greenish-gray color, and commonly contains, in great abundance, the remains of shells and fragments of radiated animals and fishes. As it admits of a fine polish, it is often used for table-slabs, etc. Dolomite, or carbonate of magnesia, is often found superincumbent above muschelkalk; and mineral springs abound in this formation, as well as immense strata of rock salt, which occur directly under the beds of shell chalk.

Rock Salt is mostly associated with gypsum, anchydrytes, or sulphate of lime (clay, sandstone, and calcareous spar); in Europe, however, it usually occurs in the new red sandstone, or associated with red marl, but is not

confined to these rocks. Most of our cooking salt is prepared from this species of rock salt. There is a lower series of tertiary formation, lying directly beneath, or forming the lowest strata of Conchylian Limestone (Germ. *Wellenkalk*), distinguished by its beautifully waved veins and irregularly distributed lines, alternate with marl, etc.

The *Bunter Sandstein—New Red Sandstone* of English writers (*Gres Bigarre* of the French), which forms the base of the Triassic system both in France and Germany is a fine-grained, quartzose, sandy deposit, and in some districts, where there is no representative of the magnesian limestone, takes its place, and rests immediately on the *Rothe todte-liegende.* It is found in immense rocky strata, mostly of a red color, but in many districts exhibits a variegated mixture of red, blue, or greenish tints, from which it derives its name. The grotesque shapes assumed by the precipitous crags of this species of rock is picturesque in the highest degree.

FOURTH ORDER.

TRANSITION FORMATION.*

Between the primitive and stratified mountain are found extensive deposits which consist of alternating strata, and present us with the first traces of the existence of living beings, whose organic remains have been discovered in a fossil state, entombed in certain of these formations whose antiquity dates back to this remote epoch.

* Designated by modern geologists as the Primary Fossiliferous Formation. Also called *paleozoic*, because they contain animal remains.—*Tr.*

The rocks of this order are of various degrees of solidity, all equally showing strong evidences of their sedimentary origin, yet some exhibit evidences of having been subjected to a more powerful chemical action than others, and consequently are more crystalline in their structure. We will commence a description of this formation with

The (*Kupfer-shiefer*) *Copper-slate* and *Zeckstein* (mine-stone) formations, which consist of calcareous matter, mingled with sandstone. It is usual to find a stratum of bituminous Shale lying directly under the Bunter Sandstone (new red), upon which is superposed an argillaceous structure of gray or blue-black Anthraconite or fetid limestone, known as Graywacke. Higher up in this series come the compact limestones, the (zechstein) mine stone, separated by many layers of black, resinous schistose, friable marl, mingled with copper and iron ores, amid which salt springs arise. Directly succeeding these calcareous strata, we find

The *Rothe-liegende* also called *Todt-liegende* (Germ.) red, dead lier, so named because it is of a red color, underlies the metalliferous strata, and is dead or worthless, as containing no metallic produce.* These deposits

* The *Plutonic Formations* have received this name because they appear to be the product of the action of fire, are generally of a dense crystalline structure, and ordinarily form immense masses; they are not arranged in regularly superposed beds, nor do they contain the remains of organized bodies. Some of them are formed by the action of volcanoes, and others are very analogous to the latter; they contain not only minerals peculiar to volcanic ejections, but also matters produced by our laboratories and furnaces. They seem to have formed the primitive crust of the globe, for we find them beneath the Neptunian formations, but they are also sometimes spread over the surface of the latter, or betwixt the different beds or strata, of which they are composed.—Ruschen.—Dana.—*Tr.*

which are indicative of great movements in the waters, constitute the formation designated by geologists under the names of Red Conglomerate, New Red Sandstone, Rothe Todt-liegende, etc. They frequently form layers six hundred feet in thickness, and contain plants belonging to the families of Algæ or Coniferæ, but scarcely ever any remains of organized beings.

The *Carboniferous Formation* embraces the extensive deposit of the Coal Measures, which, especially in England, are found in different gradations and in immense masses. They are mostly rendered impure by the great quantity of sulphur they contain, and therefore coal-mines are subject to take fire from spontaneous combustion, as the sulphur becomes heated and as the gases evolved from it are highly inflamable, they ignite in coming in contact with air or vapor, and communicating their flame to the surrounding strata or beds of coal, large fires are kindled among them. Stone-coal is evidently nothing more or less than the remains of the primitive forests reduced, in antediluvian times, to the present form by the severe action of fire.

The *Silurian Formation* or *System* is subdivided into three principal sections. The upper section consists principally of Clay Slate or Shale, Graywacke, and Sandstone, placed in strata, which alternate with one another. Limestone is often found among the clay slate strata. No organic remains exist in this formation, but perfectly developed fossilified mollusks and zoophytes, *Pecten grandævus*, *Avicule lepida*, and *Goniatidæ* are frequent. The middle section is occupied chiefly by a compact, calcareous rock of a dark color, made up of different shades of gray, and used under the name marble, as the Black Marble of Corsica. To this formation also belong the

Eiffel, Strigocephalus, and Cornita marbles. The lower section, which is made up of Graywacke, Clay Slate, Sandstone, and Limestone, also composes the principal feature of the old carboniferous deposits found in the Graywacke and Clay-Slate formations of the Rhenish territory, so rich in the fossil remains of the oldest times, and called the *Paleozoic* formation, are found in various strata in the Eiffel, Ardennes, and Maas region. In Sweden, where this formation also exists, are found layers of Alum Slate and Bituminous Shale, alternated with banks of Swinestone, more generally termed fetid limestone. In England* this formation is particularly extensive. The lowest section of the Silurian system are the rocks which form

The *Cambrian* or *Schistose System*, and are the lowest sedimentary deposits known. The first stratum consists of Graywackes, Schistose Clay, Conglomerates (a rock composed of pebbles), and dark Limestone. The Clay Slate rocks are hard, dark-colored, and split easily, therefore are used in place of shingles for roofing; coral-lines and fucoides are occasionally present. The Graywacke slate is firm but very coarse-grained, occasionally laminate, enclosing fragments of clay slate. This system of strata is developed on a grand scale, extending many thousand feet in width and thickness. The second stratum is composed of Balakalk, which is an argillaceous rock formation made up of dark, thick limestone and clay slate, is of inconsiderable extent or depth, and contains but few fossil remains, which are those of the Tere-

* Receives its name from the Siluri, the ancient Britons, who inhabited the region where these strata are most distinctly developed, and is next above the Cambrian, which is so called from Cambria, the original name of Wales.

bratula and coral genera; the former supposed to be the representatives of the very first inhabitants created in the first-formed ocean. The third section of the Cambrian group consists of various-colored clay slate earths, with laminated rocks of pure and fine-grained slates, interstratified with graywacke and silicious conglomerates is often several thousand feet in extent and depth and also contains a few corals and terebratulæ.

SECOND CLASS.

UNSTRATIFIED ROCKS OR MASSIVE IGNEOUS ROCK FORMATION.

FIRST ORDER.

PRIMITIVE MOUNTAINS OR ROCKS.

By the name of *primitive mountains* are meant those massive elevations which are the consequences of those great upheavals which, proceeding from the heart of the earth, changed its first arrangement and aided materially to give it its present form. Everywhere the strata of the primary rock formation, no longer occupying their horizontal position, but broken through, distorted, fractured or inclined, give striking evidence of the great overthrow. In many places where they have not been exactly ruptured by the upheaving force exerted from below, their immense fragments are irregularly raised up, and on the borders of those huge masses exposed to view, exhibit undeniable proofs of their igneous origin

from the masses of half fused mineral matter spread over them, and then suddenly cooled.

They consist principally of Feldspar, Quartz, Mica, and occasionally Hornblende, are frequently so crystalline in structure as to plainly exhibit the beautiful mineral materials which compose them. The metallic veins found in this formation appear originally to have been fissures, often passing through different beds of rock, and which were subsequently filled with metallic ores. They exist in primitive, transition, and secondary rocks, but are most common in the former; metallic veins often change their metals at different depths and also their dimensions.*

The most ancient portion of this formation, the earliest deposit on the first massive crust of the earth, is crystalline, namely, granite, which seems to form a basis for the whole geological structure; gniess—syenite—which consists of feldspar, hornblende, and quartz: much resembles granite; porphyry, serpentine, and greenstone, the different varieties and properties of which shall be described when we enter upon the field of special mineralogy.

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* Many theories are had respecting their origin. The earlier and some of the modern geologists (Dr. Hutton, etc.) supposed that the metals were forced into their veins in a fused state, the expansive force of the heat producing their fissures. This is called the *igneous theory* of the mineral veins. The *aqueous theory*, which is that of the celebrated Werner and his followers, is, that the fissures of dykes and veins were produced by the shrinking of the rocks in which they are contained, and that the metallic veins were afterwards filled with the metals in a state of solution poured in from the surface of the earth.—*Tr.*

SECOND ORDER.

VOLCANIC ROCKS.

Whilst the primitive rocks were gradually thrown up from the interior of the earth, partly through igneous and partly through aqueous agency, which extended over the whole surface of the globe, the *Volcanic* or *Trap Rock Formation* appears to have been produced, by a single eruption of fused matter, thrown out from the bowels of the earth by a strong subterranean power. Before we proceed to describe the Trachytic or Igneous Rock Formation, let us examine the volcanic agency which produced them. Volcanic crests or hills are generally steep, rugged, conical elevations, sometimes isolated or arranged several together on a line, with crateriform cavities on the summit, and deep internal fissures, that communicate with the internal portion of the earth, which is still considered to be in an igneous state. A continued melting process, like that of an active furnace, is always going on, from which abundance of gaseous matter is disengaged. The water penetrating these subterranean cavities filled with fused metallic or mineral matter is converted into steam, which, pressing upon the lava, forces it upwards. It then breaks forth in eruptive explosions, throwing out showers of stones, vapor, ashes, and melted lava. The craters are of various but always of considerable depths, reaching from one hundred to three hundred fathoms.

As volcanic eruptions present various phenomena, sometimes splendidly picturesque, at others terrific and appalling, they are collectively classed, under three heads, as appearing at three different periods.

First Period. A short time before the catastrophe or outbreak commences, a dull, rumbling noise is heard, as occurring far down in the earth; tremblings more or less violent are sure to succeed; these shakings continue for a shorter or longer time, at irregular intervals. These movements of the earth are of different kinds; sometimes in horizontal oscillations, at others in successive rising and falling of the soil, often jerking and twisting as if tortured by some internal agony, and are not less dangerous than open eruption. If in the neighborhood of the sea, the waters, violently agitated, sometimes advance far inward, making fearful irruptions on the coasts, at others retreating so far outward as to leave their foundations exposed. At such times the air is hot, dry, and oppressive.

Second Period. Whilst the subterranean rumblings continue, and the tremblings of the earth seems to threaten a removal from its firm foundations, the melted lava is, like boiling fluid in a caldron, rising to the top of the crater, whence—or else by fissures in the side of the mountain—it pours forth in streams of liquid fire. Columnar volumes of fire rise like gigantic pillars above the crater, amid which are seen jets of large red hot stones, ashes, and sand, hurled with Titanic force from two to three thousand feet in the air. The stream of lava is enveloped in a dark cloud of smoke; at the same time immense volumes of steam, or aqueous vapor, are evolved. Clouds of fiery volcanic dust, sand, and ashes, or pumice, fall everywhere, even to a great distance, like rain, whilst loud grumblings, like thunder, and fearful subterranean explosions issuing from the mountain, shake the earth to its very center. After the overflowing of the melted lava, these commotions gradually cease, the volume and force of the fiery stream gradually diminish, after hav-

ing destroyed every thing in its way, and at length the tumult ceases, and all is still.

Third Period. After the volcano has become quiet, and the smoke and flame has abated, new thunderings, like the firing of heavy cannon, new explosions and tremblings commence, amid which a majestic pillar of smoke ascends from the crater to a great height, and spreads an extended broad, dark canopy over the whole mountain. Spectators have likened this singular and striking phenomenon to a gigantic pine. A steady rain or shower of stones, fine volcanic dust, and pumice, or gray particles of lava, now fall from the black, overhanging cloud which canopies the mountain, extending to a considerable distance and obscuring the light of the sun. This shower of ashes often continues for many days, after which, accompanied by crashing thunder and vivid electric flashes, a dark cloud settles upon the crown of the mountain. Torrents of rain, the effect of condensed vapors, now begin to fall, and from the inundations of mud which they cause are dreaded as being more disastrous in their consequences than the streams of burning lava, and close the scene. After such fearful eruptions, various hurtful gases are generated, and issuing from the crater, pollute the air for miles around. The principal volcanic formations are, first,

Lava, which, when cooled, exhibits no regular structure; sometimes it is firm and compact above, at others porous, cellular, or scoriaceous. There are also specimens of lava which constitute regular rocklike masses; the colors are mostly brownish-yellow or greenish-gray; some, not seldom, contain mineral substances, as Obsidian (volcanic glass), etc.

Pumice Stone—Bimstein—is a light, porous scoria,

or foam-like stone, produced by volcanoes, and, from its light, spongy structure, swims on the surface of water.

Pozzuolana is a kind of tufa (a sand rock, consisting of volcanic material, either cinders or the comminuted lava) found in the vicinity of Rome, and is much valued, as, mixed with chalk or lime, it hardens in water. It is of great importance in the manufacture of molds or plaster images. Trass, used for the same purposes, is but a variety of the foregoing. Both form a hydraulic cement.

Trap Basalt—Basalts which resemble Trappean of peculiar formation, their columnar structure being a remarkable characteristic. They usually stand nearly perpendicular, their structure divided into regular prisms, with sides varying from three to eight, but mostly five or six. This irregularity appears to have been caused by objects or other substances found in the path of the fluid basalt, which is compact lava, as the basaltic pillars exhibit more regularity at their bases. The texture of basalt is fine-grained and compact, and often contains fragments of other minerals imbedded in it, such as feldspar, quartz, mica leucite, and oxide of iron, which were broken or scaled off from their original rocks by the volcanic eruption, and borne along in the stream of fluid or semifluid lava. Wherever basalts are found in crevices or fissures of other rock formations, they are observed to retain their prismatic and pillar-like form, which is supposed to be caused by some peculiar atmospheric influence during their cooling. They also exhibit hollow cavities or vesicles, apparently formed by bubbles of air during their fusion. The Giant's Causeway, in the North of Ireland, is composed of basaltic columns.

SPECIAL MINERALOGY.

Whilst Geology considers minerals as dependent relations constituting soils, and treats of their various rocks only as associated in the structure of the earth, it is the object of Special Mineralogy to consider them as independent bodies, and to describe the individual qualities of the several mineral species, very few of which, although daily met with, are to most only known by name. Preliminary to a particular discussion of their characteristic structure or uses, we will remark that they all have in common three peculiar properties, varying, however, very considerably in the different species to which they belong, as exhibited in each individual. The terms by which these properties are distinguished are *Fracture*, *Degree of Hardness*, and *Specific Gravity*.

By *Fracture*, which is of several kinds, is meant the appearance of the mineral when broken; for instance, *Conchoidal*, when the mineral breaks with a curved and convex or concave surface of fracture, resembling the inside of a shell; flint is a good example. *Uneven*, when the surface of the fracture is rough, with numerous small elevations and depressions. *Brittle*, when the parts of the mineral separate into powder on attempting to cut it. *Even*, when the surface of the fracture is nearly or quite flat. *Malleable*, when slices may be cut off or splintered, and *Hackly*, when the elevations are sharp or jagged, as in broken iron.

In order to give a definite character to the results obtained with respect to the hardness of minerals, a scale

of hardness has been introduced which serves as a standard of comparison. It is only necessary to draw the file across the specimen, or scratch one with another, and the comparative hardness is easily ascertained. The following scale consists of ten minerals which gradually increase in hardness as the ciphers advance, that is 1 to 10.

1. Talc.	6. Feldspar.
2. Rock Salt or Gypsum.	7. Quartz.
3. Calcareous Spar.	8. Topaz.
4. Fluor Spar.	9. Sapphire.
5. Apatite.	10. Diamond.

Rock Salt is usually in the scale of hardness for No. 2, and if, on drawing a file across a mineral, it is impressed as easily as *rock-salt*, the hardness is said to be two; if as easily as *Feldspar*, the hardness is 6; rock-salt, for instance, is written thus: H. = 2, 0. If the file abrades the mineral with the same ease as No. 6, Feldspar, and produces an equal depth of abrasion with the same force, its hardness is said to be 6. If with more facility than 6, but less than 7, that marks the difference and is thus written, 6 = 7.

The specific gravity of a mineral is its weight, compared with that of another substance of equal volume, whose gravity is taken at unity. For solids and liquids, distilled water at 60° Fahrenheit is the standard ordinarily used; and if a mineral weighs twice as much as water, its specific gravity is 2; if three times, 3; and is thus written: Quartz, G. = 2, 7, which means that Quartz is 2, 7 times heavier than a corresponding bulk of water. Minerals are divided into four classes: 1. Earthy Minerals; 2. Salts; 3. Carboniferous Minerals; 4. Metallic Ores or Metals.

FIRST CLASS.

EARTHY MINERALS OR EARTHS.

This class of minerals comprehends those structures which are insoluble in water, and remain unaltered by any common igneous action or force.

FIRST ORDER.

SILICA.

I. *Quartz.* Mostly white or vitreous, crystalline, transparent, sometimes only diaphanous; fracture conchoidal, emits light when rubbed in the dark, H. = 7.0. G. 2.5 to 2.7. Quartz is a constituent of many rocks, and is found almost everywhere in the form of pebbles or gravel.

There are many varieties of which the most prominent specimen is

The *Rock Crystal* or *Pure Pellucid Quartz*, which is very transparent; found in high mountain regions among granite, gneiss, etc., in vaulted openings, resembling small caves, which are filled with these beautiful crystals. These vaults, called Crystal-cellars, hidden away among rocks, are commonly discovered only by accident; many of them are found to contain crystals valued at ten thousand florins. Pure pellucid crystals are often found in rivers, which, when polished, present a brilliant appearance, as, for instance, the White Stones of the Rhine. The species of crystal known as Marowyn Stone is found in the rivers which divide French and Dutch Guiana. Although seldom of weight reaching

to one hundred, the rock crystal is very valuable; in ancient times it was made into cups and vases. Nero, on hearing of the revolt that caused his ruin is said to have dashed to pieces two cups of this kind, one of which cost him a sum equal to three thousand dollars. They are of various colors; the yellow is called Citrin or False Topaz; the brown or smoky quartz, Cairngorm Stone; the black Morion. The pure specimens are cut, set in gold, and used as jewelry; the imperfect or lower varieties are employed in glass making.

The *Amethyst*, a beautiful variety of rock crystal, is transparent; color purple or bluish-violet, sometimes pearl-gray or greenish-white, is often, like the above-mentioned, found in mountain regions; the most valuable of this family of gems, however, are native of Siberia, Persia, India, and Ceylon. The amethyst received its name on account of its supposed powers against intoxication. It is always set in gold and used for ornament, as seal rings, etc., and very frequently counterfeited by a substitution of colored glass.

Common Quartz, of foul color, less transparent and vitreous, is found everywhere, and together with sandstone, is the principal element of the primary rock formation. The most remarkable variety is the *Cat's eye*, a translucent chalcedony of a light greenish-gray or yellowish-brown color. It presents a peculiar opalescence or glaring internal reflections when cut, which reminds one of the eyes of a cat, which effect is owing to filaments of asbestos. Found in Ceylon and Hindostan, also in Treseburg in the Hartz Mountains and other places in the elevated portion of Germany. Also used for jewelry.

Chalcedony is of several varieties, and is found

opaque, as well as sub-transparent or translucent. Fracture flat conchoidal; crystalline luster subdued and waxy, is of different colors and forms. The gray, white, and brown varieties are called Common Chalcedony; often found striated, clouded, or with moss-like linear markings. Agate is variegated chalcedony. Moss Agate or Mocha Stone is the variety with dendritic or moss-like delineations. When the colors white and gray alternate with darker shades on flat horizontal planes, it is called Onyx. Found mostly in basaltic formations in the regions of Baden, Oppenau, Black Forest, and at Chemnitz in Saxony.

Cornelian is the most valuable variety; of a clear bright red color, or sometimes brownish passing into yellow through grayish-red. It loses its color, which, it is supposed, is due to oxyd of iron, by heat. Both chalcedony and cornelian are much used for ornament, as seal rings, brooches, etc.

Flint is semi-opaque, solid, dense, slightly transparent. Fracture deeply conchoidal; color gray or smoky yellow, sometimes clouded. Occurs mostly in the chalk formations, namely Champagne and England. From its peculiar structure the working of flint requires great dexterity with the hammer, nevertheless an expert flint mason will commonly make from two to four hundred flint stones per diem.

Hornstone—Chert. Very dense and firm, more brittle than flint; its fracture is splintery; color outside greenish, red, or brown; inside foul and dull. The petrified remains of wood are easily recognized in Hornstone structures. Frequent in the Erzgebirge (Mineral Mountains), Thuringia, and Black Forest. Used for

making various articles, as boxes, handles for doors or locks, etc.

Jasper is a compact, nearly or quite opaque, silicious rock of a dull red or yellow color, caused by its containing some clay and yellow or red oxyd of iron; some varieties are of green and other shades. It mostly occurs in the form of globular stones which, on being cut or sawed through, exhibit innumerable delineations of color and shapes. There are many species of jasper, all of which are useful, some being employed in paving, others are made into grind-stones, and the black, also called Lydian Stone,

Basanite or *Touch Stone* is used for trying the purity of the precious metals. Found in clay strata in the Black Forest, Hartz, Saxony, and Silesia. Admits of a high polish, but is never used as a gem.

Agate is a composite stone made up of chalcedony, jasper, hornstone, and amethyst. It is of spherical form, and occurs mostly among clay-porphyry. Agate stones are frequently hollow and contain crystals in the cavities. Native in the elevated mountain formations, and being of different colors, arranged with much delicacy and beauty, it is made into seal-rings, boxes, etc.

The *Opal* belongs to the quartz family, is milky, rather than crystalline, brittle, vitreous, and contains water, H. = 5.5 to 6.5, G. = 2.0 to 2.2. Fracture conchoidal, presents internal reflections; color milk-white, brown-green or gray, nearly translucent, passing into opaque. The first of this class is

The *Precious* or *Noble Opal.* External color usually milky, but within there is a rich play of delicate tints passing into wine color. Was known to the ancients and highly valued by them, was called *paideros* or *child*

beautiful as love. It presents opalescent internal reflections of the most beautiful and diversified colors. It occurs in irregular veins or detached masses among porphyry, and is highly valued as a gem. The handsomest opals are those found in Hungary.

Common Opal—Semi-Opal has a greasy luster or translucence; structure firm, compact, and marbled; is slightly resinous, and although mostly white, is of various colors, as gray, yellow, and green, seldom red; occurs in serpentine and basalt; is most frequent in Hungary, Saxony, and Silesia. It receives its name of Semi-Opal on account of its duller colors and being less translucent.

II.—*Diamond.* Diamonds are distinguished for their perfect transparency, their vitreous electricity when rubbed or placed in the sun, and their brilliant reflections of light and adamantine luster. The composition is pure carbon, but on account of its external resemblance to the Silicia genus, it is here placed among the minerals which compose that species. It burns and is consumed at a high temperature, producing carbonic acid gas, H. = 10 as the hardest body, G. = 3.4 to 3.6. Diamonds occur chiefly in alluvial deposits of gravel and sand, lying in detached crystals, sometimes with plain but more frequently with rounded surfaces. They were originally discovered in Bengal, but they have since been found in the East Indies, Brazil, and the Ural Mountains. The perfectly pure diamond is as transparent as water, in which state it is known as a "diamond of the first water," and commands a higher or lower price in proportion as it falls short of this perfection. Those that are colored blue, green, red, gray, or yellow, are less esteemed than the transparent, which, being considered the most orna-

mental, always bring a higher price. Most exorbitant sums are paid for diamonds, varying according to their size, pure transparency, and lustrous sparkle. The most remarkable diamonds are the following (the largest one ever known was brought to the King of Portugal* from Brazil, and uncut weighs 1680 grs., valued at £5,644,800):

The *Regent*, which belongs to the crown of France, weighs 136 carats; that of the Great Mogul, cut, weighs 275 carats, valued at 5,500,000 florins; that of the Raja of Matun in Borneo, for a long time considered the largest known, weighs 300 carats.

Diamonds are regarded as the noblest and most brilliant of all gems, and jewellers cut and set them in many shapes for ornamental purposes, as brilliants or rose diamonds. Diamond is the hardest known substance, and can be cut or polished only by its own dust or powder; hence the common saying of "diamond cut diamond." Fractured portions with good cutting edges are used for various technical purposes, such as glaziers' cutting pencils or pulverized for polishing other gems, beside being employed in various ways in the arts.

False diamonds, the preparation of which is accomplished with infinite skill by newly invented processes, are sometimes substituted in place of the true, but the imposition is easily detected, as, being so much softer, they can be operated upon by a file made of good English steel.

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* Lately supposed to be a topaz.

SECOND ORDER.

ALUMINA (CRYSTALLIZED).

I.—Precious minerals belonging the the *Clay Alumina.*

Corundum of which there are several varieties, is, except the diamond, the hardest substance known; H. = 9.0, G. = 3.9 to 4.0. Found in large crystals; luster translucent, compact, presents internal reflections only in certain portions. Corundum or the Sapphire species is pure alumina crystallized; sometimes found bright-colored, mostly grayish-brown, seldom colorless. Fracture conchoidal, imperfect in the blue variety; species easily recognized by their several characteristics. The dingy, blue-gray massive variety of coarse granular structure, called Emery, is found in large boulders in Saxony and the island of Naxos. From its extreme hardness its powder is largely employed in the polishing of glass and metals, and in the cutting of gems and other minerals.

Demantspath—Adamantine Spar, a rough, coarse, crystalline stone of dingy hue, easily divisible from the other varieties, is employed in cutting and polishing diamonds. The name *Sapphire* is sometimes used for the whole corund genus, but the true Sapphire is of a beautiful blue color and remarkable transparency. The yellow variety is known as Oriental Topaz; the red is called Ruby, and nearly rivals the diamond in value. The more common kinds of sapphire and ruby are employed in the manufacture of watches. These gems, although beautiful, are less valued as toilet ornaments than dia-

monds, because they are so easily counterfeited by the substitution of colored glass.

The *Emerald* is green, often passing into blue; transparent; H. = 7.5, to 8.0; G. = 2.6, to 2.8; of shining vitreous luster; found in Pinzgau and the Tyrol, embedded in mica slate. The finest emeralds come from Grenada; others, of less beauty but gigantic size, occur in Siberia, and Mount Zalora, in Egypt, affords a distinct variety. The Beryl, which Pliny speaks of as "green, like the sea," and when perfectly transparent, and exhibiting clear shades of sky blue or mountain green, is called Aqua-marine, or Noble Beryl, occurs in the form of long hexagonal prisms, imbedded in granite. The finest are brought from Peru.

Topaz is a perfectly transparent crystal of a reddish-yellow or wine color. H. = 8.0; G. = 3.6. Found frequently in South America. The finest crystals are brought from Minas Novas, in Brazil. Sometimes they occur in the form of pebbles, and are found in the rivers of the Southern Continent. This variety is very limpid, and are called *gouttes d'eau* (drops of water). Specimens of quartz crystal from Brazil, penetrated by topaz, are not uncommon; it also occurs in gneiss and granite. The yellow color may be changed to red by heat, but great care is requisite in the process, as the crystal is liable to be broken. Often employed in jewelry, or for polishing hard substances.

Garnet is deep red, verging into brown; pellucid, but more frequently perfectly translucent or opaque. H. = 6.5 to 7.51; G. = 3.7 to 4.3. Occurs in coarse grains; also in crystals of vitreous luster, when not milky. The pellucid or precious almandine garnets, which bring a high price, are from Ceylon and Greenland.

Pyrope, or Bohemian garnet, is the most abundant variety. Found in Bohemia, embedded in trap tufa, gneiss, and granite; occurs generally in rounded or angular grains; are very beautiful and bring a high price.

II.—*Schorl Tourmaline* is of vitreous luster, and occurs as compact, massive, and coarse columnar crystals, transparent; usually translucent to opaque; color white, yellow, brown, red, green, or black; hues not brilliant, except the varieties of red and green. The electric polarity of the fractured crystals, when heated, is a remarkable characteristic of this mineral. Fracture conchoidal, passing into uneven; brittle. H. = 7.0, to 7.5; G. = 3, 0, to 3, 3. The most important of this family is

The *Common Tourmaline*, which occurs as a compact crystal-like structure; sometimes columnar, fine, slender, and stem-like; found usually in granite, gneiss, and mica slate, in various localities; in Europe abundantly, on the St. Gothard. Color mostly the same with that of the above described, except that it is never red; some varieties are black. Tourmalines, by burning, generally intumesce more or less; some, those containing lime, fusing readily; others assuming a slaggy appearance, are of very difficult fusibility. A relative variety, very transparent, green or red, which never melts, but successfully resists the action of fire, is called Aphrite, and was most probably the Hyacinth of ancient times.

III.—*Zeolite.* H. = 5.0, to 5.5; G. = 2.1 to 2.25. Luster vitreous; color yellow, red, or yellowish light gray. The best representative of this family is

Natrolite, a beautiful stone or gem, which receives its name from *natron*, soda. Found in basalt and volcanic rocks; shape prismatic, usually slender; also in globular, stellated groups, on a white or green ground. Luster

vitreous; transparent to translucent. Occurs in Bohemia and Nova Scotia.

IV.—*Mica Family.* Mica is distinguished by its peculiar vitreous structure, and luster which passes from transparent to the translucence exhibited by mother-of-pearl. Elastic and of different hues, from colorless to red, and verging from yellow to bronze and black. H. = 2 to 2.5; G. = 2.86, to 3.1. Many varieties.

The *Common Mica* is sometimes of crystallized structure, but mostly occurs in laminate crystal plates; common everywhere, and is the principal constituent of granite, gneiss, and mica slate. The colorless mica, on account of the toughness, transparency, and the thinness of its folia, is known in Siberia as Marienglass, and divided into thin plates, like panes, is used in place of glass in windows. The laminæ of the Siberian mica often exceeds a yard in diameter. The fine fragments of mica, mixed with sand, used in Germany for numerous purposes, such as giving a lustrous sparkle to various ornamental works, etc., and according to color is known as gold or silver sand. This brilliant metallic sparkle so well resembles that of gold or silver, that those who are not acquainted with it are easily deceived. Hence it is called cat-gold, or cat-silver.

Talc is of inferior hardness, = 2.6 to 2.8; elastic; formed in laminæ, but also occurs compact or tabular. Recognized by its unctuous feel, and mother-of-pearl-like structure. Color always light gray, pale yellow, or greenish-white, translucent. Usually found in compact, pearly, foliated masses, forming large structures of rock. The purest and handsomest specimens are brought from the Alps; those of Graubunden are most esteemed. The white variety of talc is employed in the manufacture of

rouge and colored pastels; also used as polishing powder. The Romans called it *Pumex* (which has been corrupted into pumice), and employed it for various toilet purposes. In the present time it serves instead of oil to smooth the wheels of machinery. Potstone, the *Lapis ollaris* of the ancients, found on the mountains of St. Bernard, St. Gothard, etc., bears much likeness to the foliated talc we have just been describing. Various domestic utensils, stoves, etc., are manufactured of potstone, which, being very hard, almost equals iron in resisting igneous action. One stove specimen, found in Germany, is celebrated as having lasted one thousand years.

Lapis Lazuli (Ultramarine) is of rich color, Berlin or dark azure blue; luster vitreous; translucent on the edges. Occurs in compact masses; seldom as crystals. When powdered it constitutes the most beautiful and durable of blue paints, called ultramarine, and has been one of the most costly colors. H. = 5 to 6; G. = 2.3 to 2.4. Found in Siberia, Thibet, and China. Lapis lazuli is rare; highly esteemed for costly vases, and inlaid work for ornamental furniture, it is also used in the manufacture of mosaics, boxes, rings, etc. Magnificent slabs of great value are contained in some of the Italian cathedrals. The artificial ultramarine, being much cheaper, has taken the place in the arts, entirely, of the native lapis lazuli.

Turquoise.—Luster waxy, translucent on the edges; color blue, verging into green; fracture conchoidal; shape, reniform or globular masses. Turquoise is brought from Persia, and so highly valued as a gem that small specimens of the pure and finely-tinted stones, measuring but five or six lines, command a high price,

varying from one hundred to two hundred and forty florins.

V.—*Feldspath* or *Feldspar* forms an exclusive family. Luster vitreous, passing into pearly; translucent on the edges; sometimes colorless, at others white, gray, flesh-colored; seldom yellow or greenish. Brittle; fracture uneven, somewhat conchoidal. H. = 6, G. = 2.5 to 2.58. Represented first by

The *Common Feldspar*, only moderately translucent, is one of the constituents of the granite, gneiss, mica, slate, and, associated with porphyry, often occurs in crystalline or solid masses in this primary rock formation. Feldspar, decomposed and called *Kaolin*, is an important adjunct in the making of porcelain or China ware; deprived of alkali and potash it is used like gypsum to promote the fertility of fields. *Moonstone* is an opalescent variety of *Adularia*, is very hard, and, when polished, presents peculiar pearly reflections.

Labradorite — Labrador Feldspar.—Luster vitreous, translucent, pearly on the edges. This stone, especially on cleavage, presents the most beautiful series of colors from internal reflections, as blue, red, yellow, and green. H. = 6.0, G. = 2.68 to 2.72. Occurs in Finland and North America. Originally from Labrador, is abundant in New York. Receives a fine polish, and is used for making jewelry, boxes, buttons, vases, etc.

VI.—*Pitch Stone Family*, to which belong, first,

Pitch Stone, which has the luster of pitch rather than glass; translucent on the corners or edges. Color green, yellow, red, brown, gray, black; often waved or clouded. Fracture flat, conchoidal, splintery. Found in large, rock-like masses; it forms whole mountains in

Meissen, Saxony, and Hungary, etc., where it is used for making stone walls, inclosing fields. Is a volcanic product, like lava. H. = 5.5 to 6. G. = 2.1 to 2.3.

Obsidian is volcanic glass. Vitreous, like common glass, compact, often in globous crystals, translucent, but smoky; seldom colorless; mostly black and gray; sometimes yellowish red or brown. Fracture conchoidal; very brittle. H. = 6 to 7.0. G. = 2.2 to 2.4. Occurs only in volcanic regions, Island of Teneriffe, Mexico, Peru, etc. Employed in making inferior kinds of jewelry; the ancient Mexicans formerly used it for mirrors, knives, razors, and daggers.

Bimstein—Pumice Stone, is feldspath or feldspar in constitution. Porous and sponge-like, evidently, like obsidian, the *scoria* of a volcano. Luster vitreous and silk-like; translucent on the edges, mostly colorless, often gray, dull yellow, seldom brown; is very rough to the touch. H. = 6.0. G. (when broken or pounded it is so light as to swim on water) = 2.19 to 2.20. Found everywhere in the neighborhood of the volcanoes from which it has been ejected. It is used for polishing mahogany, etc.; powdered, for making filters.

VII.—*Clay.* Clay is distinguished not only by its plastic and tenacious qualities, but also by its softness and pliability. In a pure state it is white, nevertheless it is often found variously colored, and forms an important element in all the stratified deposits, whether of soils or the primary rock formation. G. = 1.8 to 2.6. The different species of clay rank thus, first,

Pipe Clay is a pure, plastic clay, and if occasionally found colored—the result of iron ores among it—it always becomes white by burning. Found in the United

States. That species from which the German pipes are made occurs in Cologne, Alsace, and Nassau.

Limestone Clay is ochreous-yellow or brown, often containing grains of quartz; is used by masons, etc., for building purposes.

Potter's Clay is gray or bluish-gray, very sectile.

Lithomarge is a compact clay, of fine, smooth texture, also grayish-blue, and very sectile. Sometimes contains mica, and absorbs a great deal of water; after drying, contracts, and becomes very hard.

Fuller's Earth, *Soapstone*, etc., claim a place here. All clays are made subservient to the use of man in making Delft ware and common pottery; for fulling or washing cloth, making tiles, and cement or plaster, refining sugar, etc. Lithomarge and Tuesite, which are impervious to water, are used as cement to line the inside of cisterns. Clay soils are damp and cold, consequently unfruitful; burnt clays are the best compost for such.

Porcelain Clay or *Kaolin* is derived from the decomposition of feldspar, as already stated; pale-colored, opaque; placed on the tongue, adheres to it; feels soft and dry; structure compact, seldom crystalline. Color white, verging into gray or red; occurs in nests among gneiss, granite, and mica-slate. Found in the United States in many places; the foreign porcelain clay occurs in Saxony, France, and England, but that of China and Japan is the finest.

Steinmark, *Myolin* or *White Lithomarge* is a pale, opaque, compact clay, of fine, smooth texture; feels somewhat greasy, and, placed on the tongue, adheres to it. Its colors are white, grayish, bluish, often reddish, white or ochre color, with a shining streak. Found in the serpentine and topaz rocks, etc., of the German

mountains; used for polishing serpentine, etc. Surface of fracture fine and even. H. = 2.5. G. = 2.4. Soapstone resembles it, but is softer.

Fuller's Earth is a white, gray, green or red earth, having a soapy feeling; slightly adhesive on the tongue. Fracture uneven; structure sometimes compact, at others laminate, with a shining, oily streak. It falls to pieces in water, but absorbs oil or grease of any kind. Found in Germany, England, and elsewhere. It was formerly used by the fullers for removing the grease from woolen cloths, for which office its faculty of absorbing oils and rejecting water peculiarly fitted it. G. = 2.19.

Bole. Luster weak, opaque, translucent, earthy. Color white, brown, yellowish, reddish. Feels greasy; fracture conchoidal; streak shining. Adheres to the tongue; bursts and falls to pieces in water, and afterwards gradually crumbles into fine powder. Found in basaltic, and clefts of other igneous rocks in Silesia, Bohemia, and Upper Italy. Bole, also called *Terra Sigillata*, is employed for various purposes, as polishing material, cement, or plaster, bowls, cups, etc., and Turkish pipes. H. = 2.0. G. = 1.9 to 2.0.

THIRD ORDER.

MAGNESIA COMBINED WITH ALUMINA.

I.—*Talc Family—Aluminates of Magnesia.* The most conspicuous of this family is

The *Spinel—Balas Ruby.* Occurs only as a crystal, translucent, often transparent; luster vitreous. Color generally red, but passing into blue, green, yellow, or dark brown. H. = 8.0, G. 3.4 to 3.8. The red spinel

is a valuable gem; the scarlet crystal is called Spinel Ruby; the rose-red, Balas Ruby; the pale-colored are less esteemed; the dark-colored crystals, brown or blackish, are known as Ceylonites. Found in Ceylon and Peru; occurs in dolomite, limestone, and gneiss.

Chrysolite—Olivine is what is called Pistachio or asparagus green, seldom yellow or brown. Luster vitreous, transparent, often only translucent. Occurs in prismatic crystals, or in compact, imbedded grains. H. = 6.5 to 7.0. G. = 3.3 to 3.5. Found in Egypt, Brazil, Bohemia, and Saxony; occurs discriminated in basalt, lavas, and meteoric iron, and is a characteristic mineral of these rocks. The brighter colored chrysolites are sometimes used as gems, but upon the whole, are little valued, and seldom employed for any purpose.

II.—*Speckstein—True Tale* or *Spanish Chalk* has an unctuous or dry soapy feel and eminently pearly luster, translucent on the edges; color mostly white, also gray, green, or reddish, sometimes arborescent or marked with radiating lines. Shines like soap on being rubbed; does not adhere to the tongue. Fracture uneven, splintery, or separating into thin translucent folia. H. = 1.0 to 2.0. G. = 2.6 to 2.8. Occurs in the serpentine rocks of Sweden, France, Germany, and also United States, and known as talcose slate or steatite. Impressible by the nail. If used for writing on glass, the impression is so permanent, that after being wiped off and the spot breathed upon, the inscription is as plain as at first.

Serpentine rarely occurs in right rectangular prisms, but is usually massive and compact in texture; translucent on the edges, nearly opaque; feels slightly oily; color white, yellow, red, but mostly green, in veins or

irregular, changeable shades. Fracture flat, conchoidal, or splintery; shines by being rubbed. H. = 3.0. G. = 2.5 to 2.6. Occurs disseminated throughout ore-beds and in granular limestone, and giving it a clouded green color, is known as verd-antique marble, seldom, however, as a gem or crystal. The common serpentine is found in Saxony, the Erzgebirge, etc., also in the eastern portion of the United States, and is employed as a material for tables and other ornamental in-door work.

Meerschaum—Sea Froth. Compact, with a smooth feel, somewhat greasy opaque; color grayish-white, with a faint yellowish tinge. Fracture fine, earthy; adheres firmly to the tongue. H. = 2.5 to 3.0. G. = 1.2 to 1.6. Found in Anatolia, Crimea, Spain, and Morocco. Occurs principally in Asia Minor at the plains of Eskihi-sher in stratified, earthy, or alluvial deposits.* When first dug up, it is soft, has a greasy feel, and lathers like soap, and on this account is used by the Tartars for washing their linen; also employed for making the bowls of Turkish pipes, by a process like that for pottery ware. These bowls are imported into Germany in their rude state, and are there prepared for sale by softening them first in tallow, then in wax, and, finally, polishing them.

FOURTH ORDER.

LIME.—MAGNESIA.

I.—*Calc Family.* *Lime* or *Limestone* occurs either in crystals as calcareous or calc spar or else in compact

* *Aphrodite* and *Quincite* are varieties found in France.

structures like marble, in which case it forms large beds of rock and even mountains. When met with as a crystal, it is mostly colorless; luster vitreous; sometimes, however, found gray, green, yellowish, very rarely red or blue, but in every case translucent. As a compact stone its hue is light gray or grayish-blue, and, with the exception of white marble, always impure. Fracture conchoidal; effervesces with acids. H. = 3.0. G. = 2.5 to 2.73. Lime is among the most useful of the minerals; calcareous spar is employed as a solvent in Metallurgy. Marble is of infinite importance in sculpture, for which purpose that brought from the quarries of Carrara and the island of Paros is best; that used for building material is called granular limestone. The more compact limestone, of variegated veins and shadings and on account of its receiving a beautiful polish, is also called marble, and applied to all purposes and varieties of stone manufactures, as slabs for tables, pedestals, cornices, etc. This species which often exhibits variegated shadings of color, and breaks out into thick slabs, is of varied structures and markings. Sienna Marble is yellow with cloudings; Bird's Eye is compact limestone, with crystal points disseminated through it; Ruin Marble is yellowish, with brownish shadings or lines, representing castles, towers, and cities in ruins; other marbles are also named after the fanciful figures they represent; the markings are due to infiltrated oxyd of iron or manganese. Ruin Marble is among the Florentine varieties of Calc. Lithographic stone is a compact grayish or yellowish-gray limestone of very even texture and conchoidal fracture; used in lithography. That of Solenhofen near Munich is most noted. The use of Chalk, a member also of this family is well known. Calcareous

Tufa, formed by deposition from waters resembles Rock-milk, but is more cellular or porous and not so soft; occasionally used for light walls, making mortars for druggists, and, lastly, as medicine. Dolomite, the white variety, used as marble, is the Magnesian Carbonate of Lime.

Gypsum—Plaster of Paris—Sulphate of Lime; mostly of compact texture, seldom crystallized, but when it is, and pure, it is as pellucid as glass, and has a pearly luster. Occurs likewise in laminated masses of large size, with a satin luster; in radiating or stellated forms; also affording foliated, flexible laminæ; color gray, reddish, brownish, and the compact variety opaque. Found in great beds among the limestone, marl, clay, and sandstone formations; very often associated with rock-salt. The pure and fine-grained snowy gypsum, also called Alabaster, and used for statuettes and small sculpture, comes from Florence. Gypsum when burnt and ground forms a white powder, which, being mixed with water, on drying becomes hard and compact. Known as Plaster of Paris, and is used for making models and stucco ornaments, taking casts, and giving a finish to walls. Gypsum is also ground and, employed as compost, is considered an important agent in improving clover fields. Anhydrite is a relative species, compact, hard, and also a sulphate of lime, like gypsum, but differs in containing no water.

II.—*Fluor spar — Flusspath — Fluoride of Calcium.*

Fluor spar or *Fluate of Lime.* Structure sometimes, although rarely, in crystal form or columnar; mostly massive, granular, coarse or fine. Luster vitreous, transparent or translucent; colorless, but also fre-

quently colored brilliantly green, blue, red. When heated, exhibits a greenish, but vivid, phosphorescence. H. = 4.0. G. = 3.1 to 3.2. Ranks on account of its clearness and bright colors among the handsomest of the minerals, and is very common in all the mining districts of Germany, particularly in those of the Hartz and Black Forest. It has the peculiarity of mixing readily with other metallic substances; as it fuses easily, is used as a flux to aid in reducing copper and other ores, whence its name Fluor. Fluor spar, in combination with sulphuric acid, developes fluoric acid, which is employed in etching on glass. The more beautiful crystal specimens are occasionally employed by the lapidary in making ornaments for inlaying cabinets, etc.

III.—*Hornblende—Tabular Spar*—seldom occurs crystallized, mostly firm or compact; luster vitreous, inclining to pearly. Slightly translucent on the edges; colorless or colored, yellow, gray, red, or brownish-white; fracture uneven; brittle; when rubbed or heated, phosphorescent. Occurs in granular limestone; abounds in Hungary, also in the United States, and is an essential constituent of certain rocks, as syenite, trap rock, and hornblende slate. H. = 4.5 to 5.0. G. = 2.8 to 2.9.

Common Hornblende. Mostly in the form of crystals, but also massive and slaty cleavage; face granulate or disseminate and radiate; translucent on the edges; crow-black, dark, or blue-black green; is the principal constituent of greenstone. Found extensively in the primary and sedimentary rock formations, associated with the metallic ores. Abounds in the Black Forest and Tyrol; equally so in the mining districts of the United States. H. = 5.0 to 6.0. G. = 2.9 to 3.4.

Asbestus is only a fine crystal variety of hornblende (*Tremolite*); made up of delicate, hair-like fibers, but so interlaced lengthwise that their structure is scarcely apparent; blades, are flexible, elastic, silky, soft; translucent, occasionally opaque; smooth to the touch. Color mostly whitish, but often of various shades of green, verging into brownish-yellow; occurs in narrow seams or blades in gneiss, mica slate, etc., in the mountains of Savoy; also in hilly regions of the eastern and middle parts of the United States. There is a coarser variety, less silky, fine, and elastic, which is called common asbestus, mountain leather, and mountain cork.

Amianthus which includes Ligniform asbestus, is composed of slender fibers, with a rich satin luster. These filamentous fibers, easily separated, can be spun and woven into incombustible cloth; the ancients used it for the wicks of lamps in their temples; also for enveloping the corpses of the dead which were to be burned, as, proof against all igneous action, the ashes remained unchanged and unscattered.

IV.—*Baryta—Strontia—Sulphate of Barytes*, or *Heavy Spar*—occurs either in the form of crystals or is of massive, compact, granular, fibrous, or coarse lamellar structure, and is distinguished from Celestine and Arragonite by its uncommonly high specific gravity. Luster vitreous; feels somewhat oily; translucent, passing into pearly. Colorless mostly, although often found of various shades of gray, yellow, and brown. H. = 3 to 3.5. G. = 4.1 to 4.7. Found in Germany, in the primary and sedimentary rock formations in the Hartz mountains, and mining region of the Black Forest; also in Connecticut, New York, and Pennsylvania, associated with the metallic ores. Heavy spar is used in many

chemical purposes and preparations; ground up it is employed as white paint; white lead and arsenic are frequently adulterated with it, an imposition not easily detected on account of its high specific gravity.

SECOND CLASS.

SALTS.

Mineral salts are distinguished by their solubility in water, and peculiar taste.

FIRST ORDER.

SALTS OF ALUMINA.

Native Alum occurs in regularly formed crystals. Colorless—very seldom colored; luster vitreous; fracture conchoidal; taste sweetish astringent; soluble in water. Sometimes it is found in compact masses, but of silky, fibrous structure; at others in efflorescent crusts, as if composed of flour; but mostly on the surfaces of rocks containing sulphur; in clay-slate, also called alum-slate, gneiss, and in most of the other formations. Met with in all volcanic regions—Silesia and Norway; also at the Solfataras, in South America. Alum is an important material in the arts, on account of its caustic nature; used in dyeing, paper-making, tanning, and also in the preparation of medicine. H. = 2.0 to 2.5; G. = 1.7 to 1.8.

SECOND ORDER.

ALKALINE SALTS—ALKALIES.

Mineral Salt is found both in the crystal form or in compact masses. Luster vitreous; slightly greasy; rather transparent; mostly colorless, but sometimes gray, yellow, or red; rarely blue; fracture conchoidal; taste purely salt; crackles when put into the fire; dissolves readily in water. H. = 2.5. G. = 2.2 to 2.3.

Rock Salt occurs in large masses, forming remarkable deposits, or hanging from the roofs of caves in the form of stalactites. Salt beds are found in rocks of various ages, from the Red Sandstone—primary, secondary—in short, in all the formations, mixed with clay, gypsum, and lime; in Europe the principal locations are Gallicia, Spain, Saltzburg, and Poland. Those of Poland and Hungary are the most remarkable. In the great salt mine of the former, near Cracow, which has been worked since 1251, its deep subterranean regions are excavated into houses, chapels, and other ornamental forms. Illumined by lamps, it presents a most imposing sight, the roof being supported by pillars of salt, which, sparkling like gems, fills the beholder not only with admiration but awe, as serving to call up the wonders of creation. The salt rocks of the Pyrenees rise up in lofty crags more than one hundred feet high. Vast lakes of salt water exist in many parts of the world. Lake Timpanoga, the Great Salt Lake of North America, has an area of two thousand square miles. The greater portion of common salt is made from the water of salt springs which issue from these saline rocks or deposits, or from wells made by

boring into them often to a depth of from fifty to one hundred and fifty feet, and having the brine raised by machinery. It is then conducted by troughs into boilers, and there evaporated by heat. The water thus impregnated by salt, is in Germany called Salsola; is made into salt by condensation. Salt is every where considered indispensable in the wants of man; not only is it valuable as a seasoning and preservative for his food, but is of infinite use in the arts, manufacture of glass, soda, etc., and in the forms of Epsom and Glauber salts well-known in medicine.

Soda. *Nitrum* of the ancients—*Saltpetre*, or *Nitrate of Potash*, of the present day—occurs in minute, needle-formed crystals, or is obtained from compact masses of earth containing it lixiviated. It is also often found in a state of efflorescence on stones, walls, etc. Luster vitreous; colorless, else green or yellow; deliquesces slightly; taste sharp and cooling. Fracture conchoidal; effloresces on exposure to the air. H. = 1.0 to 1.5. G. = 1.4 to 1.5.

Natron, a native carbonate of Soda, is formed from the condensation of the waters of a small lake (Natron Sea) in Egypt. Occurs also in other soda lakes, in Hungary, Persia, Italy, Mexico, and is particularly abundant in Chili. Natron accidentally led to the invention of glass making; the Phœnicians, having landed in Egypt, and obtained a quantity of soda, placed their kettle on some soda blocks which they fixed in a little hollow they scooped out of the sand. When the water in the kettle boiled, it ran over the top among the sand, and the soda melting with it, the two combined formed glass. Soda is of infinite importance, and is much used in soap making, by glass manufacturers, and also as

medicine is well known as soda powders. According to Herodotus soda was employed by the Egyptians in embalming.

THIRD ORDER.

MELLITE OF ALUMINA.—OXALATE OF LIME.

Honey Stone—Mellite—is a crystal; luster resinous, inclining to vitreous. Streak white; color, honey-yellow; often reddish or brownish, semi-transparent. Fracture conchoidal. Burns readily in heated air, leaving an earthy deposit. When burnt in the open air, neither smoke nor flame is observable, and it eventually acquires the color and consistence of chalk. Was formerly classed among the mineral resins as a kind of amber, which, nevertheless belongs to an entirely different family. H. = 2.0 to 2.5. G. = 1.5 to 1.6.

FOURTH ORDER.

METALLIC SALTS.

Green Vitriol—Copperas—Sulphate of Iron. Found in crystals, generally in clusters pulverulent or massive. Glassy; color greenish, passing into various shades of white; subtransparent to translucent. Taste astringent, sweetish, and metallic. Decomposes slightly in water; effloresces if exposed to the air, and turns yellow. H. = 2.0. G. = 1.8 to 1.9. As green vitriol, or sulphate of iron is the result of the decomposition of pyrites, it occurs wherever they are met with, and the most noted localities are found in old iron mines, where

air and water find admittance. The old mines of Hartz, Tyrol, and Black Forest, is its most noted locality, but always found near pyrites. Copperas is used for making ink, and in dyeing and tanning. Employed also in the manufacture of Prussian Blue, Oil of Vitriol, and medicinally.

Blue Vitriol—Sulphate of Copper. Found usually in incrustations or in the stalactitic overflowing of waters passing through copper mines; also exhibited on rocks. Structure crystal-like, luster vitreous; color deep sky-blue, verging into greenish; taste, astringent, nauseous, and metallic. Dissolves readily in water; if iron is put into the water, the metallic portion of the copper falls to the bottom. Found sometimes in old copper mines, at others it is obtained from copper springs, in the waters of which iron bars were deposited; the copper springs of Wicklow, Ireland, and the Rio Tinto mine in Spain, are the principal localities where copper is worked in solution. H. = 2.5. G. = 2.2 to 2.3. Used in coloring, in preparing paints, and also in medicine.

THIRD CLASS.

COMBUSTIBLE MINERALS.

This family of minerals is distinguished by a combustible nature, and consists of substances that burn readily, sometimes with a resinous flame, at others rather pale blue sulphurous light, which arises from the decomposition of the water present, and the formation of the gas called carbonic oxyd.

FIRST ORDER.

CARBON.

The first of this race of minerals is

Stone Coal. Mineral coal occurs either in compact masses, or detached portions, in beds or layers of different sizes, interstratified with other rock strata, as clay shales and coarse grit sandstones. Mostly sectile, sometimes brittle; color grayish-black, of shades more or less intense. Luster vitreous, resinous, sometimes sub-metallic, opaque; often rendered impure by admixture with clays, and always associated with sulphur (pyrites). H. = 2 to 2.5. G. = 1.1 to 1.5. Bituminous coal ignites easily, and burns with a bright lively flame; anthracite, called stone-coal, affords only a pale blue, sulphurous light. If coal is burned in a close receptacle, and the atmospheric air is wholly shut off, gas is evolved, and the residue, rough, ponderous, extremely hard, and highly combustible, forms coke, which is of infinite use in the smelting of metals.

Mineral coal occurs in extensive beds or layers between the clay shales and sandstones, principally those of the sedimentary and old red sandstone formations. The strata vary in thickness from a few lines to forty feet. This useful mineral is very widely distributed over the world. England, France, Spain, Belgium, Germany, especially in the region of the Rhine, the Saale, the Elbe, and the Oder. But nowhere is the coal formation more extensively displayed than in the United States, nowhere are its beds of greater thickness or its qualities more valuable. East of the Alleghanies the coal is of the hard, compact species known as anthra-

cite; going west it grows more and more bituminous, until at the western extremity of Pennsylvania (Pittsburg), as also throughout the Western States, it is altogether bituminous. Both varieties are equally excellent in furnishing fuel for fires, and gas for lighting our streets and houses.

Brown Coal—Wood Coal—Lignite—is solid, with more or less distinct traces of remains of the wood which formed its origin. Burns with clear flame and an empyreumatic odor. It occurs massive, sometimes of fibrous structure; color varying from brown to pitch black; ofttimes friable; opaque. Fracture earthy or conchoidal, luster resinous. H. = 1 to 2.5. G. = 1 to 1.4. Found in the stratified or primitive mountains of the tertiary period, below sandstone and clay, mostly in association with pyrites. Occurs very extensively in Germany, in the neighborhood of Cologne, Bonn, Eisleben, the metallic and other mountains of Thuringia, etc. The handsomest variety of lignite is Jet, which, of higher luster and deeper color than the first-named, receives a brilliant polish, and is set and used as jewelry. Also called Gagat; mentioned by Pliny and Dioscorides. The name was derived from the river Gagas, in Syria, near the mouth of which it was found; corrupted into the term jet. Found also in England.

Turf is a mixture of plants, roots, and earths, which, exposed to severe igneous action, have become combined in one common structure. Color dark brown, nearly black, fracture earthy; is used for fuel, but, previous to burning, must be dried. A kind of coal or coke, which is a better combustible than the turf itself, and burns without giving forth the usual unpleasant odor, is prepared from it.

SECOND ORDER.

MINERAL RESINS.

Sulphur. Native sulphur occurs in various shapes, as crystals, trimetric, compound, imperfect, or microscopic, the last exhibited in iron ores. Color yellow, shading into orange-yellow; sometimes contains bitumen and carbon; in such cases it is grayish. Luster resinous; transparent to translucent. H. = 1.5 to 2.5. G. = 1.9 to 2.1. Sulphur is usually met with in the neighborhood of volcanoes, also in metal deposits and strata or beds of gypsum. Burns with a blue flame at a low temperature, with a strong, unpleasant, almost suffocating odor; is insoluble in water, but melts easily by heat, and, on being fused, sublimates readily. Is used for various purposes, and in various forms, as material for igniting other bodies, sulphuric acid, bleaching, in the manufacture of gunpowder, and as medicine.

Amber—Yellow Mineral Resin—is found in large, irregular masses, mostly in alluvium; seldom in lignite or with sandstone; latterly supposed to be of vegetable origin, from the occurrence of insects or plants being encased within it. Color yellow, verging into brown, red, or white; transparent to translucent; fracture brittle; luster resinous. H. = 2 to 2.5. G. = 1 to 1.3.

The *Bernstein* of the Germans—amber—has been considered as the fossil resins of trees existing in the antediluvian world, which were swept from their places by the deluge, and aided largely in forming the vegetable deposits. Found on the sea coasts of East Prussia, at Dantzic, Denmark, Sicily, and at Norfolk and Suffolk in

England; is the *elektron* of the Greeks. From its becoming electric by friction, it gave the name electricity to science. Amber is used for many purposes: in the form of beads for ornament; for making varnishes; in Turkey is valued as mouth-pieces for their pipes, and is burnt as incense in Romish churches. Copal is often substituted in the place of amber in the making of varnish. *Succinic acid*, also called oil of amber, is also made from it, and as heat is indispensable in the preparation of amber varnish, in order to fuse the amber, both of these products are obtained at one time.

Asphaltum—Mineral Pitch—is found either solid or fluid; in the latter form it is naptha. Asphaltum proper occurs in solid, resinous masses, globular or reniform; color pitch-black and brownish black; opaque; fracture brilliant, conchoidal; luster resinous. H. = 2.0. G. = 1.1 to 1.2. Dissolves at heat corresponding with that of water at boiling point, and burns with strong, bright flame. Asphaltum is met with abundantly on the shores of the Dead Sea, and in the Island of Trinidad, where it occurs in huge solidified masses of black pitch, which look like black rocks among the trees. Sometimes, but rarely, asphaltum is found among marl and limestone, in Switzerland, Hanover, and the Black Forest. Used in making sealing-wax, varnishes, and for paving streets.

THIRD ORDER.

BITUMINOUS RESINS.

Rock-oil—Naptha or *Petrolium*—is a thin fluid, colorless or slightly yellow; has a pitch-like odor, not at all unpleasant; is very volatile and burns with a bright,

clear flame; does not change or become solid by being exposed to the air. G. = 0.75. Contains, occasionally, a portion of asphaltum, which renders it of a darker color. If the mixture of asphaltum is sufficient to render it more viscid, it is called Mineral Pitch or Mountain Tar. Occurs in clay, sand limestone, and marl; abounds on the northwestern shores of the Caspian Sea, Batku, and Modena, near which places it issues from the earth in large quantities, mostly by springs. Petrolium is is used in Birmah as lamp oil. Naptha affords both light and fuel to the inhabitants of Batku, and that obtained from the spring near Amiano is also used for illuminating the city of Genoa. There are also other springs of naptha in Italy, Alsatia, etc. Employed in various ways, it is very useful, first, as affording fuel and light; secondly, forming a substitute instead of oil for paint, or making varnish, and, in France, in forming cement for covering roofs and lining water cisterns, or making pavements.

FOURTH ORDER.

METALLIC EARTHS.

Graphite—Black Lead—Plumbago or *Carburet of Iron*—is mostly found either in solid masses, nests, or scate-like laminæ; also granular, and occasionally in prismatic form. Color, iron-gray or black, opaque; luster metallic; feels greasy, and does not fuse readily. H. = 1.2. G. = 1.8 to 2.4. Occurs in nests, at Borrowdale, England, Chamouny, France, Griesbach, in Passau, and is widely disseminated throughout the Eastern States of North America. The finest sort is used for making pencils. Receives its name, *graphite*, from

the Greek word *grapho, I write,* in allusion to its extensive use in writing. The more impure variety is good material (being fire-proof) for manufacturing fire crucibles—for diminishing the friction in heavy machinery, and is also used for giving a gloss or polish to stoves and grates.

FOURTH CLASS.

ORES.

Minerals which contain the heavy metals, either in a pure state or mixed with other substances.

FIRST ORDER.

EARTHS CONTAINING METALS.

Magnetic Iron Ore—Magnetite—occurs in six-sided or tabular crystals or prisms; generally massive, but sometimes detached and disseminate; color iron or grayish black; lustre metallic; opaque; streak black, rough; strongly magnetic, and contains a great deal of iron. H. = 5.5 to 6.5. G. = 4.5 to 5.2. Occurs in greenstone and serpentine, and is a valuable iron ore, from which the celebrated Swedish iron is made. Found in Tyrol, Styria, etc., in Europe, and in most of the Eastern States, in North America.

Chrome Iron Stone—Chromium—seldom occurs in crystals; mostly solid, granulate, or foliate; color iron-gray, shading into pitch-black; luster metallic, opaque,

resinous; streak brown. H. = 5.5. G. = 4.3 to 4.5. Found in serpentine rocks of Silesia, Styria; in the United States, Maryland, New York, Pennsylvania, Connecticut. The compounds of chrome are extensively used as pigments. Chromate of lead is the chrome yellow of the painter; used also in calico printing, dyeing, and painting of porcelain. The green oxyd of chromium gives its own color to glass, enamel, and is also employed in coloring porcelain, and chromic acid is said to be the red coloring matter of the red sapphire or ruby.

Red Iron Ore—Peroxyd of Iron. Partly crystal-like; often massive, granular; color dark, steel-gray, or iron-black, sometimes of variegated shades; streak powder, cherry-red or reddish-brown. But slightly attracted by the magnet. H. = 5.5. G. = 5.0 to 5.3. Occurs in the primitive and sedimentary rock formations, in Switzerland, region of the Rhine, mountains of Black Forest. Very abundant in the United States. Pilot Knob, in Missouri, is seven hundred feet high; another mountain, in the same region, is one hundred and fifty feet high; both consist mainly of this ore, piled, as it is stated, in masses of all sizes, from a pigeon's egg to a middle-sized church. Red Clay Ironstone, or Bloodstone, is of a variety of more solid structure; earthy; conspicuous from its blood-red hue, passing into steel-gray. Found in all the mountain metallic regions of Germany, and in the Alps, mostly associated with the more earth-like, brownish-red substance known as Red ocher. Is an excellent iron ore, but on account of frequent admixture with sulphur, does not rank quite so high as magnetic iron.

Brown Iron Stone—Limonite—Brown Hematite. Usually massive, sometimes of lenticular form, and often with a smooth, stalactitic surface, having a compact,

fibrous structure within. H. = 5.0 to 5.5. G. = 3.6 to 3.8. Color all shades of brown, opaque; streak yellowish-brown; luster sub-metallic; often contains manganese. The most important variety belonging to the composition of Brown Hematite, is what is called Clay Iron-stone, or lenticular argillaceous ore, consisting of small oolitic or globular masses, of brownish color, and flat, earthy fracture. Yellow ochre, another component is earthy, loose, and is of a brown or yellow color; occurs in globular and stalactitic masses. Clay Iron-stone is of dull color, impure, more or less earthy. Bog Iron ore is found in globular or obtuse granular bodies of brownish-yellow color; loose, earthy; and last of all is Umber, of dark earth color, and altogether without luster. Brown Hematite is one of the most valuable ores of iron. Found in all the stratified mountain formations in Germany and the Alps, occurring in the sand, loam, and clay strata. Ocher and Umber are employed as common materials in painting. Plate 32, fig. 4. Found also abundantly in extensive beds in all the Middle States.

Manganese Spar — Brownstone — occurs either in compound crystals or slender pyramidal shapes; also granular, with particles coherent. Color iron-black; luster metallic, opaque; streak black. H. = 2.0 to 2.5. G. = 4.6 to 4.9. Frequently found associated with Brown Hematite in Sweden, the Hartz, and Siberia. In the United States it occurs in large masses in Massachusetts and Maine. Employed by chemists in the preparation of different oxydes and chlorine. Affords a permanent glazing to stone ware, and is besides valuable in giving coloring to glass; also as forming acids used as components of several medicines and various chemical purposes.

Tin Ore—Tin Stone—is found in crystals, also massive and in grains. Colorless or yellowish-white verging into wine color or hyacinthine red, but mostly brown, passing into pitch-black, with a high adamantine luster. When in crystals, transparent to translucent. Massive, opaque, uniform and detached, infusible. H. = 6 to 7. G. = 6.8 to 7. Found in veins in the granite, gneiss, and mica slate rocks. The tin mines of Cornwall in England are far-famed; in Germany tin is worked in Saxony at Altenburg, Zinnwald, etc. Occurs also in Austria, in Malacca, Pegu, China, and in some of the East India Islands. Spain, also, and Russia can boast of their treasures of tin. The mines of Dalecarlia in Sweden are scarcely less celebrated than those of Cornwall; the latter is said to yield the best product of tin, except the mines of Bohemia. In America tin is found in Chili, Mexico, Brazil; in the United States is met with in some of the gold mines of Virginia; as native ore in Massachusetts and New Hampshire.* Plate 32, fig. 5.

White Arsenic comes in white capillary crystals; mostly colorless, but often, when impure by admixture with other substances, reddish or gray. Texture silky · luster metallic pearly, sub-transparent; taste astringent sweetish, disagreeably metallic. Occurs also as fibrous, slender stalactites; when heated gives off a baneful nauseating odor, like that of garlic. Volatizes readily, but does not dissolve easily in water. H. = 3.0. G. = 3.6

* The Cornwall mines are supposed to have been worked long before the Christian era. The Phœnecians are allowed to have traded with Cornubia. Cornwall and Herodotus (four hundred and fifty years before Christ) are believed to allude to the tin islands of Britain under the cabalistic name *Cassiterides*, derived from the Greek *kassiteros*, signifying *tin*.—DANA.—*Tr.*

to 3.7. Arsenic is a deadly poison. Taken even in small quantities, it creates a general disturbance of the system, which, at last, ends in convulsions and death. Those who work in the arsenic mines, seldom continue two years without losing their health. First there is a failure of appetite, next ensues loss of flesh, the skin becomes of a tawny hue and scales off, the hair is lost, then comes wasting fever and harassing cough; general dropsy takes possession of the system, and is the prelude to death. The best remedy against poisoning from arsenic is sugar and water or whites of raw eggs; also freshly-prepared iron rust, which is easily made with muriated tincture of iron and spirits of ammonia.

Red Copper Ore — occurs foliate, also in spirate, slender, or capillary crystals, and sometimes massive; the capillary form variety, plate 32, fig. 3, represents a structure formed of a network of fine hair-like crystals, irregularly interlaced; is the color of cochineal, passing into gray and brown; streak brownish-red; luster adamantine metallic; on being splintered is nearly transparent or translucent. It colors glass green. Found in many locations: Cornwall, England; Temeswar, Hungary; Hartz mines, etc., Germany, also in Siberia and Brazil. Observed in the United States crystallized and massive, in the copper mines of New Jersey, Connecticut, and New York. Crystals are often green from a coating of malachite. H. = 3.5 to 4. G. = 5.7 to 6.

SECOND ORDER.

METALLIFEROUS EARTHS.

METALLIC STONE ORES UNITED WITH ACIDS.

Spathic Iron—Carbonate of Iron—sometimes occurs plainly crystallized or foliated, and at others in globular or granulate aggregations. Color yellowish-gray, varying to brown; luster pearly to vitreous; partially translucent; when dark-colored, opaque. H. = 3.4 to 4.5. G. = 3.6 to 3.9. Found in the rocks at different ages, primary and sedimentary; occupies large beds in gneiss, grauwacke, and also in the coal formation; often accompanies metallic ores; occurs abundant in the Erzgebirge, Hartz, Styria, and Corinthia. English locality, Cornwall, Alstonmoor. In the United States it is found in Connecticut, traversing gneiss; occurs also in Vermont, Massachusetts, New York, and the coal regions of Pennsylvania.

Bog Ore—Iron Stone—occurs either in granular form or in brittle, loosely-aggregated, spongy masses; earthy and of various degrees of hardness and specific gravity; luster sub-metallic, dull; color ochrous, dark brown; fracture brittle, or chonchoidal, opaque. Bog iron ore is often mixed with phosphoric acid, and also with some salts of organic acids formed in marshy grounds. Proceeds from decomposition of other species, and often takes the form of leaves, etc., found in swampy soils. Bog ore is abundant in the United States. Localities, in nearly all the Eastern and Middle States; in Europe, North Germany, Russia, Sweden, Bohemia, bog ore forms large beds. Found in marshy grounds, in the

bottoms of stagnant pools or extended moors, either in foliated crystallizations or in rounded masses, and even as mud. The iron yielded by bog ore is what is called *cold short*, owing to the presence of phosphorus. Composition peroxyd of iron 85.3, water 14.7.

Calamine—Zincspath—Carbonate of Zinc. Seldom crystallized, mostly granular, compact, earthy; colorless or impure white, sometimes gray, green, brown or red; luster vitreous and pearly; sub-transparent to translucent; turns white by burning, dissolves with effervescence in nitric acid. H. = 5. G. = 4.4 to 4.5. Found in calcareous rocks belonging to the latest formations. Occurs in Silesia, Siberia, Hungary, and Poland, also in veins and beds in Pennsylvania, Missouri, Connecticut, etc., in the United States. Calamine is the most important representative of the zinc ores, is employed for many purposes, and is of especial use in the manufacture of brass.

White Lead Ore—Carbonate of Lead—Ceruse. Found in crystallized forms, in granular, or fibrous aggregations; luster partly resinous or greasy, partly metallic, adamantine. When pure, the color is white; otherwise, gray, brown, black, green, or blue; transparent, sub-translucent. By burning decrepitates strongly, fuses, and finally, with care, on charcoal, affords a globule of lead. Effervesces in nitric acid. H. = 3.0 to 3.5. G. = 6.4 to 6.6. Occurs in all the lead mines or with other lead ores in Silurian slate. Localities of best lead mines are in Europe, Germany, Bohemia, Siberia, England and Scotland, Alston Moor, United States, Perkiomen lead mines, near Philadelphia, Valle's Diggings, Missouri, and in other mines of the West, Massachusetts, North Carolina, New York, etc.

When abundant, this ore is wrought for lead. Large quantities occur about the mines of the Mississippi valley. Carbonate of lead is the *White Lead* of commerce, so extensively used as a paint. The material for this purpose is, however, artificially made, being prepared from sheet lead by the process with vinegar and wine lees. Carbonate of lead, mixed with sulphur and barytes, forms what is called *Venice White.* Caledonite is a compound of the carbonates of lead, copper, and sulphate of lead. In crystals; from lead hills and red gill; also from the Missouri mines.

Malachite—Green Carbonate of Copper. Usually in incrustations, partly earth-like, partly tuberous; structure firmly fibrous. Color light green, sometimes very bright. Crystals transparent, luster adamantine, nearly opaque; heated in a matrass, yields water, and blackens; fuses on charcoal, and affords a globule of copper; dissolves with effervescence in acids. H. = 3.5 to 4.0. G. = 3.6 to 4.0. Green malachite usually accompanies other copper ores; found in all the mines of the north in both hemispheres, those of Siberia, the Ural mountains, the Hartz in Hungary, are the most noted foreign localities. Connecticut, New Jersey, Maryland, Pennsylvania and Wisconsin have afforded handsome specimens; the ore from the Peccatonica, Wisconsin, has been smelted on the spot and exported to England. This mineral receives a high polish, and on this account, as well as that of its beautiful color, is sometimes set and used as jewelry; in Russia, where it is obtained in very large masses, it is made into vases, slabs for tables, mantle-pieces, etc., which are of exquisite beauty, owing to the delicate shadings of the radiations and zones of color.

THIRD ORDER.

SCHWEFELKIES.—IRON ORES COMBINED WITH SULPHUR.

Schwefelkies—Iron Pyrites—Bisulphuret of Iron—the most widely spread of all the ores, occurs abundantly in rocks of all ages, from the oldest crystalline to the most recent alluvial deposits, either in the form of cubes or crystals; granular stalactitic masses, and often in irregular spheroidal nodules. Color bronze-yellow, gold, red, or copper, running into brown veins, streaked brown or black; luster splendent metallic; when broken or struck sends forth a sulphurous odor, which is increased by burning on charcoal. H. = 6 to 5. G. = 4.9 to 5.1. Found in veins or ore-beds in clay-slate, graywacke; in short, all the primary rock formations, in every country, and strewn about in various localities. This species is of high importance in the arts, although not affording good iron; heated, it gives off sulphur, and by a chemical process yields sulphate of iron (green vitriol or copperas), and sulphuric acid (oil of vitriol) of commerce, and also a considerable portion of sulphur and alum. Iron pyrites were formerly used for striking fire, instead of flints.

Mispickel—Arsenical Iron Pyrites—occur in crystals, prisms, massive or irregularly granular. Color silver-white or steel-gray; luster shining and opaque. Fused (or before the blow-pipe), affords arsenical fumes, accompanied with a sulphurous odor. H. = 5.5 to 6. G. = 6 to 6.2. Localities Freiburg, Altenberg, Siebengebirge, and elsewhere in Europe; Cornwall in England, and in various places throughout the Eastern States. Found mostly in primitive regions, and is commonly as-

sociated with ores of silver, lead, iron, and copper. Serves to represent Arsenious Acid (White Arsenic, the well-known poison), and Sulphurets of Arsenic (Orpiment or King's Yellow, Yellow Sulphuret) and Realgar (Red Sulphuret) of Arsenic. Arsenious acid, with oxyd of copper, produces a fine pigment called Scheele's Green.

Smaltine—Tin-White—Arsenical Cobalt — occurs in crystalline, massive structures, also in reticulated or other imitative shapes. Color tin-white, inclining to steel-gray; streak, grayish-black; luster, metallic, opaque. By burning emits copious arsenical fumes; colors glass in a fluid state, blue; also gives a blue color to porcelain and stone-ware. Localities France, England, Sweden, and Germany; especially at Joachimstahl, in Bohemia, where it is found in veins associated with other ores of cobalt and ores of silver and copper. In Connecticut it occurs with copper nickel in veins traversing gneiss. With silex and potash it affords smalt; is scarce, and highly valued.

Copper Pyrites—Sulphuret of Copper and Iron. Form and composition compound complex crystal; also globular, massive, stalactitate, granular, sometimes impalpable. Color brassy-yellow or varied brown; luster shining, opaque; streak, greenish-black. On being roasted gives off fumes of burning sulphur. Colors glass green. H. = 3.5 to 4.0. G. = 4.1 to 4. 3. Occurs in granite, and nearly all the other formations, in veins or beds associated with other copper ores; foreign localities Ross Island, Kilkenny, Ireland, Norway, Sweden, South Tyrol, Hungary, Siberia, Freiburg in the Hartz mining regions, etc. Fine crystallizations occur in the Bristol copper mine, Connecticut, in granite, also at Cheshire, in red sandstone, and in the same State with

malachite and heavy spar. Massive varieties are found at the New Jersey mines, and in Pennsylvania.

Copper Glance—Vitreous Copper Ore. Seldom plainly crystallized, mostly of massive structure, granular or compact, and disseminate. Color lead-gray, sometimes streaked; luster shining metallic, streak blackish; opaque. H. = 2.5 to 3.0. G. 5.4 to 5.7. Heated, gives off fumes of burning sulphur. Occurs associated with the above described, and is used for the same purposes.

Silver Glance—Vitreous Silver—Sulphuret of Silver—occurs in various forms, as crystals, simple and compound; reticulated, filiform, arborescent; also massive. Color lead-gray, often brown and black, varied or veined; luster metallic, shining, flexible, opaque; streak black; intumesces by heat, and gives off a sulphurous odor. H. = 2 to 2.5. G. = 6.8 to 7.1. Localities Mexico, Chili, Peru, Chemnitz, Hungary, etc., and in the mining regions of the Schneeberg and Hartz in Germany. It is a common ore in the mines of Mexico and South America; a mass of sulphuret of silver is said to have been found at Sparta, Tennessee. Occurs also with native silver and copper in Northern Michigan; considered a highly valuable ore.

Lead Glance—Galena—Sulphuret of Lead—occurs mostly in crystals, but also in globules, reticulated, tabular and massive; color lead-gray, sometimes iridescent. Luster metallic; streak, dark gray; opaque. Decrepitates by burning, unless heated with caution, and mostly contains a portion of silver. H. = 2.5. G. = 7.5 to 7.7. Galena is found everywhere, from the primary rock formation to the Lias system; associated with ores of zinc, silver, and copper. The deposits of this ore in

the United States are remarkable for their extent. They abound in the cliff limestone in the mines of Missouri, Illinois, Iowa and Wisconsin; the lead region of the latter occupying a space of eighty-seven miles from east to west, and fifty-four from north to south. Occurs in large rich veins and deposits, in the mining regions of the Hartz, Black Forest, Bohemia, Carinthia, and mountains of Granada. Plate 32, fig. 6. The lead of commerce and lead ochre, Bleiglatt, Plumbic ochre (protoxyd of lead) is obtained from this ore. It is also employed, in its rough state for glazing common stone ware. For this purpose it is ground into an impalpable powder, and mixed with water and clay; into this liquid the earthen vessel is dipped and then baked.

Molybdenite or *Wasserblei—Sulphuret of Molybdena*—occurs in hexagonal crystals; scales, or masses thin, foliated or disseminate; color, light lead-gray; luster, metallic; has a greasy feel; fuses when heated on charcoal, gives off fumes of sulphur, detonizes with saltpeter, and dissolves in nitric acid; deflagrates with nitre. Occurs in granite and all the allied rocks of the primitive formation in numerous localities in North America, Norway, Sweden, Silesia, and in the Cornish mines in England. H. = 1 to 1.5. G. = 4.5 to 4.6.

Gray Antimony—Antimony Glance—Sulphuret of Antimony—is found usually in tufts of capillary crystals, sometimes divergent, fibrous, and columnar, at others massive, granular; color lead-gray to steel-gray, often striated; luster metallic, iridescent, opaque; fuses readily; on charcoal is absorbed, giving off fumes of sulphur; dissolves in muriatic acid with most offensive odor. H. = 2.0. G. = 4.5 to 4.7. This ore affords the antimony of commerce, namely, Crude Antimony

and Metallic Antimony. The first, obtained by simple fusion, which separates the accompanying rock, is the antimony of the shops. The smelting process extracts the pure metal and forms the latter, which, alloyed with tin, forms the metal on which music is engraved, with 4 to 16 parts lead to one of antimony, is used in the making of type metal. It is a constituent of Britannia ware.

Silverblende—Dark red Silver Ore—Sulphuret of Silver and Antimony. Composition partly of silver and partly of arsenic. In the first case it mostly occurs crystallized, in the latter the structure is massive, clustery, and disseminate. 1. That containing antimony (dark red silver ore) has a metallic adamantine luster; color crimson-black, approaching lead-gray; streak cherry-red, sometimes translucent on the edges; fuses on charcoal, gives out a sulphurous odor, and yields a dark metallic globule, from which silver may be obtained. H. = 2.5 to 3.0. G. = 5.78 to 5.85. Occurs principally with calcareous spar, native arsenic, and galena in the Hartz, Bohemia, Hungary, and Norway. In Mexico is worked extensively as an ore of silver. 2. Arsenica-blende, light red silver ore; luster adamantine; color cochineal-red; streak Aurora-red; by burning gives off sulphurous and arsenical fumes, instead of oxyd of antimony. Localities Bohemia, the Hartz and Black Forest. This is a very valuable and important ore for obtaining silver, especially at the South American mines.

Cinnabar—Sulphuret of Mercury—occurs partly in small crystals, partly in massive or fibrous structures; of disseminated globules or in arborescent formations on rocks. Color cochineal red, sometimes vary into lead-gray; streak scarlet red; luster adamantine, unmetal-

lic in dark-colored varieties, sub-transparent, translucent, opaque. By burning in a matrass, it wholly sublimates; triturated with iron filings, and afterwards melted, forms metallic quicksilver, and is highly valuable for silvering mirrors, employed also for thermometers, barometers, and is indispensable for various purposes in medicine and the arts. Principal localities, the mines of Almaden in Spain, Idria in Austria, Peru, Mexico, New Granada, and China. Cinnabar ore is the great source of the mercury of commerce, from which it is obtained by sublimation. H. = 2.0 to 2.5. G. = 8.6 to 8.7. Used also as vermilion, a well known valuable pigment.

Yellow Orpiment—Rauschgelb—Yellow Sulphuret of Arsenic. Crystals massive, foliated, columnar, sometimes reniform; luster resinous or pearly; color different shades of lemon yellow; streak, paler yellow, translucent, sectile; thin laminæ obtained by cleavage, flexible. Burns on charcoal with a whitish-yellow flame, and emits fumes of sulphur and arsenic, which are its component parts. Found in veins in the mining regions of the Hartz, Siebengebirgen, Tyrol, also in the volcanic districts, where it is the result of volcanic sublimation. H. = 1.5 to 2.0. G. = 3.4 to 3.5. Is very poisonous.

FOURTH ORDER.

PURE OR NATIVE ORES.

METALS MORE OR LESS PURE, OR NATIVE METALS.

Pure or *Native Iron* is steel-gray, passing into silver-white, after casting black; luster metallic, magnetic;

with rough surface, very tough and hard; contains nickel and several other metals. Whether or not native iron is of terrestrial origin, is a question of some doubt; it is by many believed to be found pure only in meteoric stones (stones which have fallen from the heavens). The phenomena of iron rain, or the falling of single stones, although rare, have really occurred at certain periods, also in masses like stones, of large size and in considerable numbers.* Meteoric stones are always hot when they reach the earth, on account of the great rapidity with which they descend. Many opinions have been formed respecting their origin; some (the fewest number) believe them to be the ruins of some disruptured sphere; this conjecture is, however, very improbable; others have supposed them to be the germs of those newly existing bodies, called Asteroids; and a third party contend that they are the ejections of some mighty volcano in the moon. This opinion, supported as it is by astronomical observation, is the most probable conclusion, yet, how they have been produced must ever remain a mystery. H. = 5.0 to 6.0. G. = 6.0 to 7.8. The chemical sign for iron is ♂.

Native Copper is met with in crystallized forms, variously modified, sometimes also in massive shapes, arborescent, filiform, and loosely disseminate in minute particles. Color copper red, often brown and yellow striated; luster metallic, opaque, ductile, malleable; dissolves readily in nitric acid, and produces a blue solution with ammonia. Found in the primary and transition rock formations in Hungary, Sweden, Norway, Siberia,

* One of the most extraordinary of these meteorites is preserved in the cabinet of Yale College; weighs 1635 pounds; length 5 feet 4 inches; breadth 2 feet, 4 inches; height 1 foot, 4 inches.

Germany, and most abundantly in North America; but no known locality in the world exceeds in the abundance of native copper the Lake Superior region, where it occurs mostly in vertical seams in trap and masses of sandstone. A large bowlder, weighing 3704 pounds, taken from thence is now at Washington, and another from the same vicinity, weighing 137 pounds, has been many years in the Yale College collections. H. = 2.5 to 3.0. G. = 8.3 to 9.0. Chemical sign ♁.

Native Lead. Lead rarely occurs pure, but when met with, shows itself thread-like, in thin laminæ or globules, coarse or fine granular. Color lead-gray; opaque; ductile, malleable; fuses easily; dissolves in nitric acid, but precipitates in sulphuric acid. H. = 1.0 to 2.0. G. = 11. This species, of doubtful existence and very rare, is said to be met with at Alstonmoor, England, in lava in Madeira, in the mines of Carthagena, Murcia, in carboniferous limestone, Bristol, and at Kenmore, Ireland. Chemical sign ♄.

Native Mercury or *Quicksilver* exists in a native state, but occurs mostly as a sulphuret (cinnabar), in small fluid globules or drops scattered along the gangue.* Luster, strongly shining metallic: color, tin-white; opaque. Freezes at 32° R., boils at 280° R., vaporizes at all degrees of heat; dissolves readily in nitric acid. The common name of quicksilver is a translation of the old name for mercury, *argentum vivum.* G. = 13.5 to 13.6. Found always associated with cinnabar. Chemical sign ☿.

* The rock immediately enveloping the ore is called the *Gangue.* A vein often consists for the most part of the rock material called the Gangue. The usual gangue in metallic veins is either quartz, calc-spar, or heavy spar; less frequently fluor spar.—Dana.

Native Silver occurs in various forms, as compound crystals, coarse and fine filiform shapes, reticulated, string-like or arborescent; also in plates, superficial coatings, and granular, compact masses. Color and streak silver-white; subject to tarnish, by which the color changes to yellowish or grayish-black. Luster metallic, opaque; ductile, malleable. Dissolves in nitric acid, and with a solution of sea-salt and cream of tartar, precipitates as chloride of silver. H. = 2.5 to 3.0. G. = 10.3 to 10.5. Chemical sign ⊛. The European localities which have afforded the finest specimens of native silver are Konigsberg in Norway (these mines are now mostly under water), Saxony, Freiburg, Schneeberg, Black Forest, the Hartz and Ural mountains, also in the Altai at Schlangenberg, and in some of the Cornish mines. Occurs mostly in the primary and transition rock formations.

No silver mines, however, can compete with those of Peru, Chili, and Mexico. One specimen brought from the latter weighed four hundred pounds; another, from the mines of Huantaga, weighed over eight hundred weight. During the first eighteen years of the present century more than 8,180,000 marks of silver were afforded by the mines of Guanaxuoto alone. Since the discovery of the rich silver mines of America, the amount of the precious metal obtained is enormous. These alone, in three hundred and eleven years, have furnished 512,700,000 marks of silver. Upon the whole, it is calculated that at the present time 3,924,000 marks of pure silver are obtained from the American mines, and of the 8,000,000 sterling which is calculated as the value of the silver annually furnished by the mines of the world, two-thirds are obtained from Mex-

ico. In the United States silver is disseminated through much of the copper of Michigan. Also found in New Jersey, and in King's Mine, North Carolina. Plate 32, fig. 2.

Native Gold occurs pure in cubes; crystals very small; also in grains, laminæ and masses, filiform, reticulated; also in arborescent tufts of moss-like shapes. Often in flattened scales or plates, and in rolled masses in gravel or sand detritus. Luster metallic. Color varying from different shades of gold yellow to brassy and silver-gray; opaque; ductile, malleable. Gold is often rendered impure by being mixed with silver; also often contains copper and iron. H. = 2.5 to 3.0. G. = 12.6 to 19.09. Chemical designation ☉. Dissolves in aqua regia, or a mixture of muriatic and nitric acids. Gold is widely distributed all over the globe, although seldom found in large masses. Mostly occurs in quartz, pyrites (auriferous), brown iron-stone, feldspar, hornblende, stone, and in conglomerate and stratified transition rocks; the detritus affording gold has proceeded from the gold-bearing rocks. Occurs in the Ural Mountains, Peru, Mexico, New Spain, California, Brazil; also in Hungary, Siebengebirgen, Saltzburg, Graubunden; and in very small quantities in Bohemia, Hartz, and Tyrol. The Russian mines are said to be, at present, the most productive in the world. Considerable quantities of gold sand or gold dust is obtained from the alluvial washings of the large rivers of South America called *wash gold*. The sands of the Rhine, Rhone, Danube, Isar, Moselle, and other rivers in Germany contain gold in small quantities; of these the Rhine has been the most productive; at present only $9,000 are extracted annually. The whole amount of gold in the

auriferous sands of the Rhine is estimated at $30,000,000. Africa yields annually 4,500 pounds, troy, $850,000, and Southern Africa 1,250 pounds, $235,000. The mines of South America and Mexico were estimated by Humboldt to yield annually about $11,500,000, Brazil 17,500 pounds troy; and between 1790 and 1830 Mexico produced $31,250,000 in gold, Chili $13,450,000, and Buenos Ayres $19,500,000, making an average annual yield of $16,050,000.

The mines of the Southern United States have produced of late about a million of dollars annually. Localities of gold mines in the United States are Virginia, North and South Carolina, Georgia, and Eastern Tennessee. The California gold mines are mostly alluvial. The gold is found in the gravel and sand of the valleys and beds of streams leading from the Sierra Nevada into the adjoining valleys of the Sacramento and San Joaquim. Pebbles of quartz abound in this region, also magnetic iron. Native gold is also found disseminated through quartz and talcose rocks, confined to veins; the precious grains may sometimes be seen shining in the cavities of the quartz rock, or sparkling on a surface of fracture. Plate 32, fig. 1.

Native Platinum seldom occurs in crystals; most commonly in flattened or angular grains or irregular masses; is never pure, but combined with more or less of the rare metals, as iridium, palladium, etc., besides copper, iron, and chrome. Luster metallic; color steel-gray, opaque; ductile and malleable. H. = 5.0 to 6.0. G. = 17.1 to 17.9. Pure platinum is the hardest and most infusible of all metals, and is, besides, the heaviest body known; its weight, when freed from all alloy, being G. = 21.0. It occurs with native gold in brown iron-

stone (Hematite), especially in greenstone and syenite (granite containing hornblende in place of mica), mostly however, in alluvial or drift material and detritus from the crystalline rocks. Discovered of late years in great abundance in the Ural mountains, Burmah or Borneo, and South America. The Demidoff mines in the Ural, produce a large amount of platinum, amounting annually from six to seven thousand marks. On account of its dull gray lead color, platinum is considered less valuable for ornamental purposes than gold or silver; nevertheless it is a highly important and useful metal. Its infusibility even in the highest temperature (as it can only be operated upon by intense artificial heat and strong pressure, and its property of resisting nearly all chemical agents as well as the action of air and water), renders it most valuable in the construction of philosophical and chemical apparatus. It fuses before the compound blowpipe, dissolves in boiling aqua regia, but is altogether unaffected by sulphuric or any other of the pure acids. In scarcity, beauty, ductility and indestructibility it is thus scarcely inferior to gold.

We have now concluded our task of investigating the three Kingdoms of Nature, and in presenting specimens from each, trust, that although our sketches are necessarily imperfect (for the field is a wide one), we shall have interested our readers so far as to induce a further study of the wonders of Creation, and enlarge their conceptions of the wisdom, power, and goodness of Him who could call a world from naught. In the curious and wonderful structure of man, the highest link in the chain of being—passing down through the graduated scale of existence to the lowest zoophyte—in the whole

economy of the universe, animate and inanimate, is everywhere to be traced the evidences of the wisdom, the skill, the benevolence and justice of that great overruling Intelligence "who has made all things, who upholds all things," and whose works all praise Him. Let the young student, then, in contemplating the whole assemblage which constitutes the perfection of the earth—his own curious structure first—from the beasts of the forests, the fish of the sea, and birds of the air; the reptiles that live in the dark recesses, the insects that flutter throughout their life's short day in the sunshine, the chambered shells of the ocean caves and odorous flowers, the rich mineral and metallic treasures of the earth, recognize in all, for all proclaim it, the prospective benevolence of the Great Creator, who thus prepared the world as a fitting residence for His favcrite creature, Man.

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BOTANICAL GLOSSARY.

ABRUPT.—Terminating suddenly.

ACULEATE.—Prickly.

ACEROSE.—Stiff, sharp.

ACUMINATE.—Ending in a tapering point.

ACUTE.—Sharp, not rounded at the point.

AGARIC.—Mushroom.

AKENE.—A one-seeded fruit, often bony or nut-like.

ALGÆ.—Mosses.

ALTERNATE.—Placed alternately on the axis or receptacle.

AMENTS.—Slender spikes of flowers. Catkins.

ANNULAR.—In form of a ring.

ANTHER.—The capsule containing the pollen.

APETALOUS.—Without a corolla and petals.

ARBORESCENT.—Tree-like.

AROMATIC.—Having a spicy flavor or fragrance.

AURANTIUM.—An orange.

AVENA.—Oats.

AWNED.—Furnished with slender bristles—on the chaff of grasses.

AXIL.—The angle where the leaf unites with the stem.

AXILLARY.—Belonging to the axil.

BACCATE.—Fleshy, succulent; like a berry.

BIFID.—Two-cleft.

BIPINNATIFID.—The common petiole. Having opposite pinnatifid branches.

BULB.—A kind of bud formed of numerous fleshy scales or coats usually seated on the neck of the root.

CALYX.—The flower-cup or outer covering of a flower.

CARPELS.—Certain appendages of the pistil—a constituent portion of compound fruit.

CALLOUS.—Gristle-like.

CORDATE.—Heart-shaped.

CORYMB.—Helmet. Bearing the flowers all on the same level on the summit.

COROLLA.—The flower. A little crown.

CORIACEOUS.—Leathery.

CRENATE.—Having rounded teeth.

CORYMBILOSE.—Having the flowers in little corymbs.

CYMES.—A kind of panicle with irregular subdivisions.

DENTATE.—Toothed.

DIGITATE.—Spread out like the fingers.

DISCOID FLOWER.—Having a disk without rays.

DECIDUOUS.—Falling of leaves at the usual time.

DISK.—The surface of a leaf, or the face or central part of a compound flower.

DRUPE.—A fleshy pericarp without valves, containing a nut or stone.

DRUPACEOUS.—Nut-like.

ELLIPTICAL.—Oval.

ENTIRE.—Whole. Even at the edge.

FALCATE.—Sickle-shaped. Curved.

FASCICLE.—A bundle. Foot-stalks proceeding from the same point.

FROND.—The leaf or leaf-like expansion of cryptogamous plants.

FLORETS.—A little flower. One of the number in an aggregated or compound flower.

GLOBOUS.—Spherical.

GENICULATE.—Forming an angle at the joints like a bent knee.

HILUM.—The scar or mark on a seed. Black spot on a bean.

HIRSUTE.—Rough-haired.

HISPID.—Bristly.

HOARY.—Covered with white powder.

IMBRICATE.—When the scales of a stalk or calyx lie over one another, like the scales of a fish or shingles on a roof.

LANCEOLATE.—Tapering. Like the head of a spear.

LEAFLETS.—The small constituent leaves of a compound leaf.

LEGUME.—Bean-pod-like.

LOBE.—The division of a petal or leaf.

MARGINATE.—Having the border or edging of a texture or color different from that of the disk.

MUCRONATE.—Having a small point projecting from an obtuse end. The midrib in leaves.

MULTIFID.—Many-cleft.

NODE.—The knot or joint of a stem or branch.

OBOVATE.—With the broadest end above.

OBTUSE.—Blunt, or rounded.

OVATE.—Flat, ovoid, egg-shaped, as leaves, etc.

PALMATE.—Hand-shaped.

PANICLE.—A loose, irregular bunch of flowers with subdivided branches.

PAPPUS.—The crown of the fruit, usually hairy, sometimes feathery, chaffy.

PECTINATE.—Resembling the teeth of a comb.

PEDICEL.—The ultimate division next to the flower or fruit.

PEDUNCLE.—The common footstalk of the flower or fruit.

PERFOLIATE.—With the stem pierced through the leaf.

PERIANTH.—The tegumentary part of a flower.

PERICARP.—The seed-vessel or fruit.

PETIOLE.—The foot-stalk of a leaf.

PINNATE.—Having distinct leaflets on opposite sides of a simple petiole.

PISTIL.—The organ which occupies the center of a fertile flower.

PISTILLATE FLOWERS.—Having pistils but no stamens.

PLICATE.—Folded, plaited, or crimped.

PLUMOUS.—Feather-like.

POLLEN.—The fertilizing powder contained in the anthers.

POME.—A succulent, fleshy fruit—apple-like.

PUBESCENCE.—The hairy covering of plants.

PUNCTATE.—Covered with indented points.

RACEMES.—Bunches, clusters.

RAYS.—Florets diverging round the margin of a compound flower.

RECEPTACLE.—A dilated portion of the peduncle containing nutritive matter.

RENIFORM.—Kidney-shaped.

RETICULATE.—Resembling net-work.

SCAPE.—A peduncle proceeding directly from the root, mostly leaflets.

SERRATE.—Having sharp teeth like those of a saw.

SESSILE.—Sitting close without any foot-stalk.

SINUATE.—Having incisions, open and rounded at bottom.

SPIKE.—An assemblage of axillary flowers arranged on a simple axis.

STAMEN.—The organ of a flower which prepares the pollen.

STAMINATE FLOWER.—Having stamens but not pistils.

STIGMA.—The summit of the pistil.

STRIATE.—Marked or scored with parallel lines or minute ridges.

SULCATE.—Furrowed or grooved.

TERETE.—Round, like a column.

TERNATE.—Three-fold. Three together, like the leaflets of clover.

TOMENTOUS.—Clothed with a cottony pubescence.

TRI-FOLIATE.—Leaves arranged in threes.

UMBEL.—A form of inflorescence resembling an open parasol. Formed by the expansion of several peduncles into one flower.

VALVES.—The several parts of a seed vessel.

VERTICIL.—A whorl. Flowers or leaves surrounding the stem in a ring.

VILLOUS.—Clothed with numerous long, soft hairs.

WHORLS.—See Verticil.

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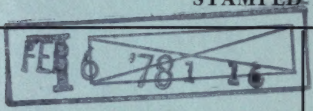

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